### BLACK & VEATCH

South Florida Water Management District EAA Reservoir A-1 Basis of Design Report

January, 2006

# APPENDIX 13-4 INFLOW PUMP STATION

July, 2005

### **INTAKE DESIGN**

#### EAA RESERVOIR A-1 INFLOW PUMP STATION

#### FORMED SUCTION INTAKE GEOMETRY - HI 9.8

Capacity (cfs)		750
Capacity (gpm)		336623
Throat Diameter d (feet)		8.50
Width of FSI Opening W (feet)		19.64
Height of FSI Opening Hr (feet	)	7.48
Length of FSI from Pump Cen	terline (feet)	28.05
FSI Opening Area D (sq feet)	147	
Diameter of Circle Equivalent	to FSI Opening D (sf)	13.68
Diameter D (inches)		164
Submergence (inches)		257
Submergence (ft)		21.4
Minimum Water Depth Above	Floor	25.15
Low Water Shut Off Elevation		7.0
Intake Floor Slab Elevation		-18.15
Approach Velocity at Rack (fps	s)	1.32

July, 2005

### EAA RESERVOIR A-1 INFLOW PUMP STATION

### **RECTANGULAR PUMP INTAKE GEOMETRY - HI 9.8**

Capacity (cfs)	600
Capacity (gpm)	269298
Bell Area (sq ft)	109.08
Bell Diameter (ft)	11.79
Bell Diameter (inches)	141
Submergence (inches)	234
Submergence (ft)	19.5
Distance Bell Centerline to Entrance (ft)	58.9
Distance Bell Centerline to Backwall (ft)	8.8
Distance Bell Inlet to Floor (ft)	5.9
Bay Width (ft)	23.6
Minimum Water Depth Above Floor	25.41
Minimum Water Depth Above Floor Low Water Shut Off Elevation	7.0
Intake Floor Slab Elevation	-18.41
Approach Velocity (fps)	1.00

### BLACK & VEATCH

## South Florida Water Management District **EAA Reservoir A-1 Basis of Design Report**

July, 2005

#### EAA RESERVOIR A-1 INFLOW PUMP STATION

#### **RECTANGULAR PUMP INTAKE GEOMETRY - HI 9.8**

0	4.000
Capacity (cfs)	1,000
Capacity (gpm)	448830
Bell Area (sq ft)	181.80
Bell Diameter (ft)	15.22
Bell Diameter (inches)	183
Submergence (inches)	288
Submergence (ft)	24.0
Distance Bell Centerline to Entrance (ft)	76.1
Distance Bell Centerline to Backwall (ft)	11.4
Distance Bell Inlet to Floor (ft)	7.6
Bay Width (ft)	30.4
Minimum Water Depth Above Floor	31.61
Low Water Shut Off Elevation	7.0
Intake Floor Slab Elevation	-24.61
Approach Velocity (fps)	1.04

July, 2005

SYSTEM HYDRAULIC ANALYSIS

July, 2005

#### **EAA RESERVOIR A-1 INFLOW PUMP STATION**

#### (3) 1000 cfs Vertical Axial Flow Pumps

PUMP ANALYSIS - SUCTION REQUIREMENTS Submergence at Rated Conditions (feet) Distance from Impeller to Bell or Center of FSI Vapor Pressure (feet) Atmosperic Pressure (feet) NPSHA (feet)	24.2 10.0 1.2 33.9 46.9
Q at Runout Conditions (estimated gpm)	538,560
Suction Specific Speed (assumed)	8,500
Maximum Pump Rotative Speed (rpm)	208
Speed Factor - Maintain Speed in Range 50 to 120 fps	2.77
Head at BEP (feet)	13.0
Stages	1
Q at BEP (gpm)	448,833
Impeller Peripheral Velocity (fps)	80.15
Impeller Diameter D <sub>2</sub> (feet)	10.00
Impeller RPM	153
Specific Speed	14987
Static Head (feet)	8.5
Dynamic Head (feet)	5.8
Q Rate of Flow (cfs)	1000
System Efficiency	0.78
Specific Energy	1144

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#### EAA RESERVOIR A-1 INFLOW PUMP STATION

#### (3) 1000 cfs Horizontal Axial Flow Pumps

PUMP ANALYSIS - SUCTION REQUIREMENTS Submergence at Rated Conditions (feet) Distance from Impeller to Bell or Center of FSI Vapor Pressure (feet) Atmosperic Pressure (feet) NPSHA (feet) Q at Runout Conditions (estimated gpm) Suction Specific Speed (assumed)	24.2 30.0 1.2 33.9 26.9 538,560 8,500
Maximum Pump Rotative Speed (rpm)	137
Speed Factor - Maintain Speed in Range 50 to 120 fps Head at BEP (feet) Stages Q at BEP (gpm) Impeller Peripheral Velocity (fps) Impeller Diameter D <sub>2</sub> (feet) Impeller RPM	2.75 10.0 1 448,833 69.79 10.25 130
Specific Speed	15499
Static Head (feet) Dynamic Head (feet) Q Rate of Flow (cfs) System Efficiency	6.0 6.6 1000 0.78
Specific Energy	1008

July, 2005

#### EAA RESERVOIR A-1 INFLOW PUMP STATION

#### (4) 750 cfs Vertical Axial Flow Pumps

PUMP ANALYSIS - SUCTION REQUIREMENTS Submergence at Rated Conditions (feet) Distance from Impeller to Bell or Center of FSI Vapor Pressure (feet) Atmosperic Pressure (feet) NPSHA (feet) Q at Runout Conditions (estimated gpm) Suction Specific Speed (assumed)	21.4 8.0 1.2 33.9 46.1 403,950 8,500
Maximum Pump Rotative Speed (rpm)	237
Speed Factor - Maintain Speed in Range 50 to 120 fps Head at BEP (feet) Stages Q at BEP (gpm) Impeller Peripheral Velocity (fps) Impeller Diameter D <sub>2</sub> (feet) Impeller RPM	2.25 20.0 1 336,624 80.75 8.50 182
Specific Speed	11136
Static Head (feet) Dynamic Head (feet) Q Rate of Flow (cfs) System Efficiency	12.0 8.0 750 0.78
Specific Energy	1600

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#### **EAA RESERVOIR A-1 INFLOW PUMP STATION**

#### (5) 600 cfs Vertical Axial Flow Pumps

PUMP ANALYSIS - SUCTION REQUIREMENTS Submergence at Rated Conditions (feet) Distance from Impeller to Bell or Center of FSI Vapor Pressure (feet) Atmosperic Pressure (feet) NPSHA (feet) Q at Runout Conditions (estimated gpm) Suction Specific Speed (assumed)  Maximum Pump Rotative Speed (rpm)	19.5 6.0 1.2 33.9 46.2 323,160 8,500
maximum rump (coauve opeed (rpm)	205
Speed Factor - Maintain Speed in Range 50 to 120 fps Head at BEP (feet) Stages Q at BEP (gpm) Impeller Peripheral Velocity (fps) Impeller Diameter D <sub>2</sub> (feet) Impeller RPM	2.58 15.0 1 269,300 80.19 7.50 204
Specific Speed	13910
Static Head (feet) Dynamic Head (feet) Q Rate of Flow (cfs) System Efficiency	5.8 9.3 600 0.78
Specific Energy	1208

EAA RESERVOIR A-1 INFLOW PUMP STATION ALTERNATIVE 5	
(5) 600 cfs Vertical Axial Flow Pumps	
PUMP ANALYSIS - SUCTION REQUIREMENTS	
Submergence at Rated Conditions (feet)	19.5
Distance from Impeller to Bell or Center of FSI	6.0
Vapor Pressure (feet)	1.2
Atmosperic Pressure (feet)	33.9
NPSHA (feet)	46.2
Q at Runout Conditions (estimated gpm)	323,160
Suction Specific Speed (assumed)	8,500
Maximum Pump Rotative Speed (rpm)	265
Speed Factor - Maintain Speed in Range 50 to 120 fps	2.58
Head at BEP (feet)	15.0
Stages	1
Q at BEP (gpm)	269,300
Impeller Peripheral Velocity (fps)	80.19
Impeller Diameter D <sub>2</sub> (feet)	8.00
Impeller RPM	192
Specific Speed	13040
Static Head (feet)	12.0
Dynamic Head (feet)	6.6
Q Rate of Flow (cfs)	387
System Efficiency	0.78
Specific Energy	1488

CAN DOTTON TO MAN	100	2	Max. Static Head w/ Siphon = 15.0 ft.	w/ Siphon = 15.	0 ft.			
BEGINNING GPM GPM INCREMENT SYSTEM EFFICIENCY	0.5 348,833 . 20,000 0.78	22210	Max. Static Head w/o Siphon = 23.0 ft. at 80% cap. Min. Static Head w/ Siphon = -4.0 ft. Min. Static Head w/o Siphon = 16.0 ft. Head w/s siphon at rated capacity = 7.5 ft.	w/o Siphon = 2: w/ Siphon = -4.0 w/o Siphon = 16 w/o Siphon = 16 rated capacity	3.0 ft. at 80% cap ft. .0 ft. = 7.5 ft.	Max. Static Head w/o Siphon = 23.0 ft. at 80% cap.  Min. Static Head w/ Siphon = -4.0 ft.  Min. Static Head w/o Siphon = 16.0 ft.  Head w/ siphon at rated capacity = 7.5 ft.	4	
		0 > 0 < 4	Vet Season Average = 15.64 ft at 10.0 ft. suction Dry season Average = 17.55 ft. at 10.0 ft. suction Add 80 ft. for discharge tunnel length.  Add 75 ft. for FSI Add 10.0 ft for 90 elbow and 75 for 45 elbow	age = 15.64 ft age = 17.55 ft. af narge tunnel len	t 10.0 ft. suction gth.			
		Z STISS IN	Add 2.5 to static head for internal pump losses.	ead for internal	pump losses.	TOTAL	BRAKE	
GPM	CFS	(FT/SEC)	HEAD (FT)	HEAD (FT)	HEAD (FT)	HEAD (FT)	유	
348833	777	9.90	1.5	10.0	1.7	13.2	1494	
368833	822	10.47	1.7	10.0	1.9	13.6	1624	
388833	866	11.04	1.9	10.0	2.1	14.0	1761	
408833	911	11.60	2.1	10.0	2.3	14.4	1906	
428833	955	12.17	2.3	10.0	2.5	14.8	2059	
448833	1000	12.74	2.5	10.0	2.8	15.3	2221	
468833	1045	13.31	2.7	10.0	3.0	15.8	2391	
488833	1089	13.87	3.0	10.0	3.3	16.2	2571	
508833	1134	14.44	3.2	10.0	3.5	16.8	2760	
528833	1178	15.01	3.5	10.0	3.8	17.3	2959	
548833	1223	15.58	3.8	10.0	4.1	17.8	3169	
568833	1267	16.14	4.0	10.0	4.4	18.4	3389	
588833	1312	16.71	4.3	10.0	4.7	19.0	3621	

UMP	<u>c</u> .	Min. Static Head w/o Siphon = 16.0 ft.  Head w/ siphon at rated capacity = 7.5 ft.  Start-up: el.10.0 suction to mid-height of siphon = el. 26.0 ft. = 16.0 ft.		7	TOTAL BRAKE	HEAD (FT) Hp	27.3 2290			28.2 2914	28.6 3134							31.5 4886	32.0 5171
8,833 GPM) PU	o ft. .0 ft. at 80% ca ft.	.0 ft. = 7.5 ft. ight of siphon =	10.0 ft. suction gth.	or 45 elbow	FRICTION	HEAD (FT)	1.0	1.1	1.3	1.4	1.6	1.8	2.0	2.2	2.4	2.7	2.9	3.1	3.4
ımp Station - 1000 CFS (44	// Siphon = 15.0 //o Siphon = 23 // Siphon = -4.0	//o Siphon = 16. rated capacity = uction to mid-he	age = 15.55 ft. at ge = 17.55 ft. at narge tunnel len	elbow and 75 fo	STATIC	HEAD (FT)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5
EAA Reservoir Pump Station ALTERNATIVE 1 - 1000 CFS (448,833 GPM) PUMP	Max. Static Head w/ Siphon = 15.0 ft. Max. Static Head w/o Siphon = 23.0 ft. at 80% cap. Min. Static Head w/ Siphon = -4.0 ft.	Min. Static Head w/o Siphon = 16.0 ft.  Head w/ siphon at rated capacity = 7.5 ft.  Start-up: el.10.0 suction to mid-height of the start-up.	Wet Season Average = 15.55 ft at 10.0 ft. suction Dry season Average = 17.55 ft. at 10.0 ft. suction Add 80 ft. for discharge tunnel length.	Add 100 ft. for 90 elbow and 75 for 45 elbow Add 100 ft. for 90 elbow and 75 for 45 elbow	VELOCITY	HEAD (FT)	0.8	1.0	1.1	1.3	4.1	1.6	1.8	2.0	2.2	2.4	2.6	2.9	3.1
A E	ÄÄÄ	≅ ï ö :	\$ <b>0 8</b>	₹ <b>₹</b> ₹	VELOCITY	(FT/SEC)	7.35	7.92	8.49	9.06	9.62	10.19	10.76	11.33	11.89	12.46	13.03	13.60	14 16
120	0.5 0.5 259,066	20,000				CFS	277	622	999	711	755	800	845	889	934	978	1023	1067	1112
STATIC HEAD (FT) INSIDE DIAMETER (IN)	C - FACTOR (100 TO 140) BEND FACTOR (K) BEGINNING GPM	GPM INCREMENT SYSTEM EFFICIENCY				GPM	259066	279066	299066	319066	339066	359066	379066	399066	419066	439066	459066	479066	40006

							BRAKE	운	1703	1860	2022	2191	2366	2548	2736	2933	3137	3349	3570	3800	4040
ΔM	,	Head w/ siphon at rated capacity = 7.5 ft. Start-up: al. 10.0 suction to mid-height of siphon = el. 26.0 ft. = 16.0 ft.					TOTAL	HEAD (FT)	20.3	20.6	20.9	21.2	21.6	21.9	22.3	22.7	23.1	23.6	24.0	24.5	25.0
EAA Reservoir Pump Station ALTERNATIVE 1 - 1000 CFS (448,833 GPM) PUMP	Max. Static Head w/ Siphon = 15.0 ft.  Max. Static Head w/o Siphon = 23.0 ft. at 80% cap.  Min. Static Head w/ Siphon = -4.0 ft.  Min. Static Head w/o Siphon = 16.0 ft	= 7.5 ft. ight of siphon = 0	10.0 ft. suction	gth.	r 45 elbow	pump losses.	FRICTION	HEAD (FT)	1.0	1.1	1.3	4.1	1.6	1.8	2.0	2.2	2.4	2.7	2.9	3.1	3.4
ump Station - 1000 CFS (44	w/ Siphon = 15.0 w/o Siphon = 23 w/ Siphon = -4.0 w/o Siphon = 16	rated capacity =	ge = 17.55 ft. at	harge tunnel len	elbow and 75 fo	ead for internal	STATIC	HEAD (FT)	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5
EAA Reservoir Pump Station ALTERNATIVE 1 - 1000 CFS	Max. Static Head w/ Siphon = 15.0 ft. Max. Static Head w/o Siphon = 23.0 ft Min. Static Head w/ Siphon = -4.0 ft. Min. Static Head w/o Siphon = 16.0 ft. Min. Static Head w/o Siphon = 16.0 ft.	Head w/ siphon at rated capacity = 7.5 ft.  Start-up: el. 10.0 suction to mid-height of siphon =	Dry season Average = 17.55 ft. at 10.0 ft. suction	Add 80 ft. for discharge tunnel length. Add 75 ft. for FSI	Add 100 ft. for 90 elbow and 75 for 45 elbow	Add 2.5 to static head for internal pump losses	VELOCITY	HEAD (FT)	0.8	1.0	1.1	1.3	4.1	1.6	4.8	2.0	2.2	2.4	2.6	2.9	3.1
ш∢	2222	ΙOS	۵	44	Þ		VELOCITY	(FT/SEC)	7.35	7.92	8.49	90.6	9.62	10.19	10.76	11.33	11.89	12.46	13.03	13.60	14.16
18.5 120 330	100 0.5 259,066 20,000	0.78						CFS	277	622	999	711	755	800	845	889	934	978	1023	1067	1112
STATIC HEAD (FT) INSIDE DIAMETER (IN) PIPE LENGTH (FT)	C - FACTOR (100 TO 140) BEND FACTOR (K) BEGINNING GPM GPM INCREMENT	SYSTEM EFFICIENCY					į	GPM	259066	279066	299066	319066	339066	359066	379066	399066	419066	439066	459066	479066	499066

	BRAKE	1284 1402 1527 1660 1801 <b>1951</b> 2277 2454 2641 2838 3047
EAA Reservoir Pump Station ALTERNATIVE 1 - 1000 CFS (448,833 GPM) PUMP Max. Static Head w/ Siphon = 15.0 ft. Max. Static Head w/ Siphon = -4.0 ft. Min. Static Head w/o Siphon = -4.0 ft. Min. Static Head w/o Siphon = -4.0 ft. Min. Static Head w/o Siphon = -4.0 ft. Moreover Static Head w/o Siphon = -4.0 ft. Head w/ siphon at rated capacity = 7.5 ft. Start-up: el.10.0 suction to mid-height of siphon = el. 26.0 ft. = 16.0 ft. Wet Season Average = 17.55 ft. at 10.0 ft. suction Dry season Average = 17.55 ft. at 10.0 ft. suction Add 80 ft. for discharge tunnel length. Add 75 ft. for FSI Add 100 ft. for 90 elbow and 75 for 45 elbow Add 2.5 to static head for internal pump losses.	TOTAL HEAD (FT)	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1
8,833 GPM) PU 0 ft. at 80% cap ft. 0 ft. 10 ft. 10.0 ft. suction 10.0 ft. suction gth. 75 elbow pump losses.	FRICTION HEAD (FT)	
ump Station -1000 CFS (44 w/ Siphon = 15.0 w/o Siphon = -4.0 v/o S	STATIC HEAD (FT)	
EAA Reservoir Pump Station ALTERNATIVE 1 - 1000 CFS (448,833 GPM) PUMP Max. Static Head w/ Siphon = 15.0 ft. Max. Static Head w/ Siphon = 4.0 ft. Min. Static Head w/o Siphon = 4.0 ft. Min. Static Head w/o Siphon = 16.0 ft. Head w/ siphon at rated capacity = 7.5 ft. Start-up: el. 10.0 suction to mid-height of siphon = el. 2 Wet Season Average = 15.64 ft at 10.0 ft. suction Dry season Average = 17.55 ft. at 10.0 ft. suction Add 80 ft. for discharge tunnel length. Add 75 ft. for FSI Add 100 ft. for 90 elbow and 75 for 45 elbow Add 2.5 to static head for internal pump losses.	VELOCITY HEAD (FT)	
MA SSESTESOAAAA	VELOCITY (FT/SEC)	9.90 10.47 11.04 11.60 12.74 13.31 14.44 15.01 16.14
8.14 120 330 100 0.5 348,833 20,000 0.78	CFS	777 822 866 911 955 1000 1045 1089 1134 1178 1223 1267
STATIC HEAD (FT) INSIDE DIAMETER (IN) PIPE LENGTH (FT) C - FACTOR (100 TO 140) BEND FACTOR (K) BEGINNING GPM GPM INCREMENT SYSTEM EFFICIENCY	GPM	348833 368833 408833 448833 448833 508833 548833 568833 568833

		BRAKE	운	1499	1630	1767	1913	2066	2228	2399	2579	2768	2968	3178	3398	3630
AP.	Max. Static Head w/ Siphon = 15.0 ft.  Max. Static Head w/o Siphon = 23.0 ft. at 80% cap.  Min. Static Head w/o Siphon = -4.0 ft.  Min. Static Head w/o Siphon = -16.0 ft.  Min. Static Head w/o Siphon = 16.0 ft.  Head w/ siphon at rated capacity = 7.5 ft.  Start-up: el.10.0 suction to mid-height of siphon = el. 26.0 ft. = 16.0 ft.  Wet Season Average = 15.64 ft at 10.0 ft. suction  Add 80 ft. for discharge tunnel length.  Add 75 ft. for FSI  Add 100 ft. for 90 elbow and 75 for 45 elbow  Add 2.5 to static head for internal pump losses.	TOTAL	HEAD (FT)	13.3	13.6	14.0	14.5	14.9	15.3	15.8	16.3	16.8	17.3	17.9	18.5	19.0
EAA Reservoir Pump Station ALTERNATIVE 1 - 1000 CFS (448,833 GPM) PUMP	Max. Static Head w/ Siphon = 15.0 ft.  Max. Static Head w/o Siphon = 23.0 ft. at 80% cap.  Min. Static Head w/ Siphon = -4.0 ft.  Min. Static Head w/o Siphon = 16.0 ft.  Head w/ Siphon at rated capacity = 7.5 ft.  Start-up: el. 10.0 suction to mid-height of siphon = e  Net Season Average = 15.64 ft at 10.0 ft. suction  Dry season Average = 17.55 ft. at 10.0 ft. suction  Add 80 ft. for discharge tunnel length.  Add 75 ft. for FSI  Add 100 ft. for 90 elbow and 75 for 45 elbow  Add 2.5 to static head for internal pump losses.	FRICTION	HEAD (FT)	1.7	1.9	2.1	2.3	2.5	2.8	3.0	3.3	3.5	3.8	4.1	4.4	4.7
ump Station - 1000 CFS (44	w/ Siphon = 15.0 w/o Siphon = 23 w/ Siphon = -4.0 w/o Siphon = 16. rated capacity = 16.0 rated capacity = 16.64 ft at ge = 17.55 ft. at arge tunnel lenguage = 17.55 ft. at arge tunnel lenguage = 17.55 ft. at arge tunnel lenguage = 17.55 ft. at arge = 17.55 ft.	STATIC	HEAD (FT)	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1
EAA Reservoir Pump Station ALTERNATIVE 1 - 1000 CFS	Max. Static Head w/ Siphon = 15.0 ft.  Max. Static Head w/o Siphon = 23.0 ft. at 80% ca  Min. Static Head w/o Siphon = -4.0 ft.  Min. Static Head w/o Siphon = 16.0 ft.  Head w/ Siphon at rated capacity = 7.5 ft.  Start-up: el. 10.0 suction to mid-height of siphon = Wet Season Average = 15.64 ft at 10.0 ft. suction  Dry season Average = 17.55 ft. at 10.0 ft. suction  Add 80 ft. for discharge tunnel length.  Add 75 ft. for FSI  Add 100 ft. for 90 elbow and 75 for 45 elbow  Add 2.5 to static head for internal pump losses.	VELOCITY	HEAD (FT)	1.5	1.7	1.9	2.1	2.3	2.5	2.7	3.0	3.2	3.5	3.8	4.0	4.3
я¥		VELOCITY	(FT/SEC)	9.90	10.47	11.04	11.60	12.17	12.74	13.31	13.87	14.44	15.01	15.58	16.14	16.71
10.05 120 330	100 0.5 348,833 20,000 0.78		CFS	777	822	866	911	955	1000	1045	1089	1134	1178	1223	1267	1312
STATIC HEAD (FT) INSIDE DIAMETER (IN) PIPE LENGTH (FT)	C - FACTOR (100 TO 140) BEND FACTOR (K) BEGINNING GPM GPM INCREMENT SYSTEM EFFICIENCY		GPM	348833	368833	388833	408833	428833	448833	468833	488833	508833	528833	548833	568833	588833

_	d cap.		BRAKE	롸	1847	2012	2181	2355	2534	2719	2911	3108	3313	3524	3743	3969	4204
3 GPM) PUN	@ 80% ratec	mp losses.	TOTAL	HEAD (FT)	22.0	22.3	22.5	22.8	23.1	23.4	23.7	24.1	24.4	24.8	25.2	25.6	26.0
EAA Reservoir Pump Station ALTERNATIVE 2 - 1000 CFS (448,833 GPM) PUMP	Max. Static Head w/ Siphon = 15.0 ft. Max. Static Head w/o Siphon = 18.0 ft. @ 80% rated cap. Min. Static Head w/ Siphon = -4.0 ft. Min. Static Head w/o Siphon = 11.0 ft. Head w/ siphon at rate capacity = 7.5 ft.	Add 2.5 ft. to static head for internal pump losses. Add 50 ft. for discharge tunnel length Add 75 ft. for FSI Add 175 ft. for Elbows	FRICTION	HEAD (FT)	0.8	6.0	1.0	1.2	1.3	1.5	1.6	1.8	2.0	2.2	2.4	2.6	2.8
EAA Reservoir Pump Station ALTERNATIVE 2 - 1000 CFS	Max. Static Head w/ Siphon = 15.0 ft. Max. Static Head w/o Siphon = 18.0 f Min. Static Head w/ Siphon = -4.0 ft. Min. Static Head w/o Siphon = 11.0 ft Head w/ siphon at rate capacity = 7.5	static head for discharge ture FSI	STATIC	HEAD (FT)	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5
EAA Reservi ALTERNATI	Max. Static Head w/ Siphon = 15.0 ft. Max. Static Head w/o Siphon = -4.0 ft. Min. Static Head w/ Siphon = -4.0 ft. Min. Static Head w/o Siphon = 11.0 ft. Head w/ siphon at rate capacity = 7.5	Add 2.5 ft. to static head for internal p Add 50 ft. for discharge tunnel length Add 75 ft. for FSI Add 175 ft. for Elbows	VELOCITY	HEAD (FT)	0.7	6.0	1.0	1.1	1.3	4.1	1.6	1.7	1.9	2.1	2.3	2.5	2.7
			VELOCITY	(FT/SEC)	6.89	7.42	7.95	8.48	9.01	9.54	10.08	10.61	11.14	11.67	12.20	12.73	13.27
20.5	259,066 20,000 20,000 0.78			CFS	277	622	999	711	755	800	845	888	934	978	1023	1067	1112
HEAD (FT) MAMETER (IN)	CTOR (K) NG GPM REMENT EFFICIENCY			GPM	259066	279066	299066	319066	339066	329066	379066	390066	419066	439066	459066	479066	499066

South Florida Water Management District **EAA Reservoir A-1 Basis of Design Report** 

Cab	BRAKE Hp 1438 1558 1685 1818 1957 2259 2421 2592 2771 2958 3155
© 80% rated (© 80%	TOTAL HEAD (FT) 12.7 13.0 13.7 14.1 14.1 14.9 15.3 16.2 16.6
tion FS (448,83; FS (448,83; n = 15.0 ft. on = 18.0 ft. n = 4.0 ft. acity = 7.5 ft. deff. at 10.0 fr. internal pur	FRICTION HEAD (FT) 1.4 1.4 1.9 1.9 2.1 2.5 2.7 2.9 3.3 3.3 3.6
ir Pump Sta TE 2 - 1000 C ead w/ Sipho ead w/o Sipho ead w/o Sipho ead w/o Sipho on at rate cap eage = 15 verage = 17. static head fo discharge tur FSI	HEAD (FT) 1 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10
EAA Reservoir Pump Station ALTERNATIVE 2 - 1000 CFS (448,833 GPM) PUMP Max. Static Head w/ Siphon = 15.0 ft. Max. Static Head w/o Siphon = 4.0 ft. Min. Static Head w/o Siphon = 4.0 ft. Min. Static Head w/o Siphon = 11.0 ft. Head w/ siphon at rate capacity = 7.5 ft. Wet Season Average = 15.64 ft. at 10.0 ft. suction Dry Season Average = 17.55 ft. at 10.0 ft. suction Add 2.5 ft. to static head for internal pump losses. Add 50 ft. for discharge tunnel length Add 175 ft. for Elbows	VELOCITY HEAD (FT) 1.3 1.5 1.7 1.8 2.0 2.0 2.4 2.6 2.8 3.1 3.3 3.3 3.3
. 2222130444	9.27 9.80 10.34 10.87 11.40 11.40 12.99 13.53 14.06 14.06 14.06
10 124 300 100 0.5 348,833 20,000 0.78	CFS 777 822 866 911 955 1089 1178 1223 1267 13412
STATIC HEAD (FT) INSIDE DIAMETER (IN) PIPE LENGTH (FT) C - FACTOR (100 TO 140) BEND FACTOR (K) BEGINNING GPM GPM INCREMENT SYSTEM EFFICIENCY	GPM 348833 368833 408833 428833 488833 528833 528833 528833 528833 5588833 558833 558833 558833 558833 558833 558833 558833 558833 558833 558833 558833 558833 55

	cap.	BRAKE Hp	1228 1336 1450 1571 1699 1834 1976 2127 2285 2452 2628 2813
GPM) PUM	@ 80% rated ft. suction ft. suction mp losses.	TOTAL HEAD (FT)	0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01
tion FS (448,833	n = 15.0 ft. on = 18.0 ft. 1 = 4.0 ft. on = 11.0 ft. acity = 7.5 ft. 64 ft. at 10.0 55 ft. at 10.0 or internal pur	FRICTION TOTAL HEAD (FT) HEAD (FT)	1.1.1.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2
oir Pump Sta /E 2 - 1000 C	ead w/ Sipho ead w/o Sipho ad w/ Siphor ad w/o Siphor on at rate cap Average = 15 verage = 17. static head fo discharge tur FSI	STATIC HEAD (FT) I	
EAA Reservoir Pump Station ALTERNATIVE 2 - 1000 CFS (448,833 GPM) PUMP	Max. Static Head w/ Siphon = 15.0 ft.  Max. Static Head w/o Siphon = 18.0 ft. @ 80% rated cap.  Min. Static Head w/o Siphon = -4.0 ft.  Min. Static Head w/o Siphon = 11.0 ft.  Head w/ siphon at rate capacity = 7.5 ft.  Wet Season Average = 15.64 ft. at 10.0 ft. suction  Dry Season Average = 17.55 ft. at 10.0 ft. suction  Add 2.5 ft. to static head for internal pump losses.  Add 50 ft. for discharge tunnel length  Add 175 ft. for Elbows	VELOCITY HEAD (FT)	
		VELOCITY (FT/SEC)	9.27 9.80 10.34 11.40 12.99 13.53 14.59 14.59 15.65
8.14 124 300	100 0.5 348,833 20,000 0.78	CFS	777 822 866 911 955 1000 1045 1134 1178 1223 1267
STATIC HEAD (FT) INSIDE DIAMETER (IN) PIPE LENGTH (FT)	C - FACTOR (100 TO 140) BEND FACTOR (K) BEGINNING GPM GPM INCREMENT SYSTEM EFFICIENCY	GPM	348833 368833 408833 428833 448833 508833 548833 568833 568833

ñ	۵.		cab.					BRAKE	Н	1444	1564	1691	1824	1964	2112	2266	2429	2600	2779	2967	3164	3371
	ALTERNATIVE 2 - 1000 CFS (448,833 GPM) PUMP		Max. Static Head w/o Siphon = 18.0 ft. @ 80% rated cap.			ft. suction ft. suction mp losses.		TOTAL	HEAD (FT)	12.8	13.1	13.4	13.8	14.1	14.5	14.9	15.3	15.8	16.2	16.7	17.2	17.7
ıtion	FS (448,833	n = 15.0  ft.	ion = 18.0 ft.	n = -4.0 ft.	on = 11.0 ft.	Head w/ siphon at rate capacity = 7.5 ft.  Wet Season Average = 15.64 ft. at 10.0 ft. suction  Dry Season Average = 17.55 ft. at 10.0 ft. suction  Add 2.5 ft. to static head for internal pump losses.	nnei lengu	FRICTION	HEAD (FT)	4.1	1.6	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.6	3.8
oir Pump Sta	/E 2 - 1000 C	ead w/ Sipho	ead w/o Siph	ad w/ Sipho	ad w/o Siph	on at rate cap Average = 15 verage = 17 static head fo	discharge tu FSI r Elbows	STATIC	HEAD (FT)	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1
EAA Reservoir Pump Station	ALTERNATIV	Max. Static Head w/ Siphon = 15.0 ft.	Max. Static H	Min. Static Head w/ Siphon = -4.0 ft.	Min. Static Head w/o Siphon = 11.0 ft.	Head w/ sipho Wet Season / Dry Season A Add 2.5 ft. to	Add 50 ft. for fischarge tunnel length Add 75 ft. for FSI Add 175 ft. for Elbows	VELOCITY	HEAD (FT)	1.3	1.5	1.7	1.8	2.0	2.2	2.4	2.6	2.8	3.1	3.3	3.6	3.8
_		_	_	_	_			VELOCITY	(FT/SEC)	9.27	9.80	10.34	10.87	11.40	11.93	12.46	12.99	13.53	14.06	14.59	15.12	15.65
10.05	300	100	0.5	348,833	20,000	0.78			CFS	777	822	866	911	922	1000	1045	1089	1134	1178	1223	1267	1312
STATIC HEAD (FT)	INSIDE DIAMETER (IN) PIPE LENGTH (FT)	C - FACTOR (100 TO 140)	BEND FACTOR (K)	<b>BEGINNING GPM</b>	GPM INCREMENT	SYSTEM EFFICIENCY			GPM	348833	368833	388833	408833	428833	448833	468833	488833	508833	528833	548833	568833	588833

South Florida Water Management District **EAA Reservoir A-1 Basis of Design Report** 

July, 2005

1414 1585 1770 1967 22179 2648 2908 3185 3481 3796 4432 4489

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	EAA Reservoir Pump Station ALTERNATIVE 3 - 750 CFS (336,625 GPM) PUMP	ated cap.		0 suction 0 ft suction		TOTAL HEAD (FT)	18.5	19.1	19.8	20.5	21.3	22.1	22.9	23.8	24.8	25.8	26.9	28.0	29.1
	ation FS (336,62ŧ	Max. Static Head = 15.25 ft. @ 80% rated cap Head at rated capacity = 12.25 ft.		Dry Season Average = 17.55 ft. at 10.0 suction Wet Season Average = 15.64 ft at 10.0 ft suction Add 350 ft. for flap valve Add 25 ft for discharge pipe	sessol du	FRICTION HEAD (FT)	2.4	2.8	3.2	3.6	4.1	4.6	5.1	5.7	6.3	6.9	7.5	8.2	8.9
	oir Pump St VE 3 - 750 C	lead = 15.25 d capacity =	ead = 8.25 ft	Average = 17 Average = 1 or flap valve discharge pi	or Elbows FSI r internal pur	STATIC HEAD (FT)	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8
	EAA Reservoir Pump Station ALTERNATIVE 3 - 750 CFS (	Max. Static Head = 15.25 ft. @ 80 Head at rated capacity = 12.25 ft.	Min. Static Head = 8.25 ft.	Dry Season Average = 17.5 Wet Season Average = 15.6 Add 350 ft. for flap valve Add 25 ft for discharge pipe	Add 175 ft. for Elbows Add 75 ft. for FSI Add 2.5 ft. for internal pump losses	VELOCITY HEAD (FT)	1.3	1.6	1.8	2.1	2.4	2.7	3.0	4.6	3.8	4.2	4.6	2.0	5.4
						VELOCITY (FT/SEC)	9.30	10.08	10.87	11.65	12.44	13.22	14.01	14.80	15.58	16.37	17.15	17.94	18.72
N	14.75 102 550	100	236,625	0.78		CFS	527	572	616	661	705	750	795	839	884	928	973	1017	1062
0410.0 SAX	STATIC HEAD (FT) INSIDE DIAMETER (IN) PIPE LENGTH (FT)	C - FACTOR (100 TO 140) BEND FACTOR (K)	BEGINNING GPM GPM INCREMENT	SYSTEM EFFICIENCY		GPM	236625	256625	276625	296625	316625	336625	356625	376625	396625	416625	436625	456625	476625

South Florida Water Management District **EAA Reservoir A-1 Basis of Design Report** 

		BRAKE	1079	1235	1576	1763	71962	2400	2640	2896	3169	3459	3768
EAA Reservoir Pump Station ALTERNATIVE 3 - 750 CFS (336,625 GPM) PUMP Max. Static Head = 15.25 ft. @ 80% rated capacity Head at rated capacity = 12.25 ft. Min. Static Head = 9.25 ft.		TOTAL HEAD (FT)	19.7	20.2	21.2	21.8	22.5	24.0	24.8	25.6	26.5	27.4	28.4
ation FS (336,626 ft. @ 80% ra	np losses	FRICTION HEAD (FT)	1.3	2. L 6. D	2.2	2.6	3.0	3.0	4.4	4.9	5.5	6.1	6.7
oir Pump Sta /E 3 - 750 Cl ead = 15.25 I capacity = 1 ead = 9.25 ft.	r internal pur discharge pi or flap valve FSI or Elbows	STATIC HEAD (FT)	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8
EAA Reservoir Pump Station ALTERNATIVE 3 - 750 CFS (336,625 GPM) PUM Max. Static Head = 15.25 ft. @ 80% rated capacity Head at rated capacity = 12.25 ft. Min. Static Head = 9.25 ft.	Add 2.5 ft. for internal pump losses Add 25 ft for discharge pipe Add 350 ft. for flap valve Add 75 ft. for FSI Add 175 ft. for Elbows	VELOCITY HEAD (FT)	0.7	0.0	1.3	7.5	1.7	2.3	2.6	2.9	3.3	3.6	4.0
		VELOCITY (FT/SEC)	6.65	7.44 8.22	9.01	9.79	10.58	12.15	12.94	13.72	14.51	15.29	16.08
17.75 102 550 100 0.5 169,300 20,000		CFS	377	422 466	511	555	645	689	734	778	823	867	912
C HEAD (FT) E DIAMETER (IN) ENGTH (FT) CTOR (100 TO 140) FACTOR (K) INING GPM NORREMENT		GPM	169300	189300 209300	229300	249300	269300	309300	329300	349300	369300	389300	409300

South Florida Water Management District **EAA Reservoir A-1 Basis of Design Report** 

		BRAKE Hp	1204	1346 1499	1841 2031	2235 2453 2686	2936 3202 3485
EAA Reservoir Pump Station ALTERNATIVE 3A - 750 CFS (336,625 GPM) PUMP	Max. Static Head w/ siphon = 15. ft. @ 80% rated cap. Head w/ siphon at rated capacity = 7.5 ft. Min. Static Head w/o siphon = 8.25 ft. Max. Static Head w/o siphon 15.25 ft. Dry Season Average = 17.55 ft. at 10.0 ft. suction Wet Season Average = 15.64 ft at 10.0 ft suction Add 1.0 ft. for exit loss Add 50 ft for discharge pipe Add 175 ft. for Elbows Add 75 ft. for FSI Add 2.5 ft. for internal pump losses	TOTAL B HEAD (FT)	14.5	15.0 15.6	16.9 17.6	18.3 19.1 19.9	20.8 21.7 22.6
ation CFS (336,6	Max. Static Head w/ siphon = 15. ft. @ 80% rated Head w/ siphon at rated capacity = 7.5 ft. Min. Static Head w/o siphon = 8.25 ft. Max. Static Head w/o siphon 15.25 ft. Dry Season Average = 17.55 ft. at 10.0 ft. suction Wet Season Average = 15.64 ft at 10.0 ft suction Add 1.0 ft. for exit loss Add 50 ft for discharge pipe Add 175 ft. for Elbows Add 75 ft. for FSI Add 2.5 ft. for internal pump losses	FRICTION HEAD (FT)	1.9	2.5	3.5 3.5	3.9 4.3 4.7	5.1 6.1 6.1
oir Pump St	lead w/ siph on at rated c ead w/o siph lead w/o siph Average = 1. Average = 1 r exit loss discharge pi or Elbows FSI	STATIC HEAD (FT)	1.1.		<b>2</b>	<u> </u>	<u> </u>
EAA Reservoir Pump Station ALTERNATIVE 3A - 750 CFS	Max. Static Head w/ siphon = 15. ft. @ Head w/ siphon at rated capacity = 7.4 Min. Static Head w/o siphon = 8.25 ft. Max. Static Head w/o siphon 15.25 ft. Dry Season Average = 17.55 ft. at 10. Wet Season Average = 15.64 ft at 10. Add 1.0 ft. for exit loss Add 50 ft for discharge pipe. Add 175 ft. for Elbows Add 75 ft. for FSI Add 2.5 ft. for internal pump losses	VELOCITY HEAD (FT)	1.6	2.2.8	3.0	3.8 4.8 4.2 4.2	5.0 5.0 5.4
	212207	VELOCITY VELOCITY (FT/SEC) HEAD (FT)	9.30	10.87	13.22 14.01	14.80 15.58 16.37	17.15 17.94 18.72
11.05	236,625 236,625 20,000 0.78	CFS	527 572	616	750 750 795	839 884 928	973 1017 1062
STATIC HEAD (FT) INSIDE DIAMETER (IN) PIPE LENGTH (FT)	O 140)	GPM	236625	276625 296625	316625 336625 356625	376625 396625 416625	436625 456625 476625

South Florida Water Management District **EAA Reservoir A-1 Basis of Design Report** 

<b>⊕</b>	ф.	BRAKE Hp	925	1045	1175	1316	1468	1633	1811	2002	2208	2429	2666	2919	3190
EAA Reservoir Pump Station ALTERNATIVE 3A - 750 CFS (336,625 GPM) PUMP	Max. Static Head w/ siphon = 15. ft. @ 80% rated cap. Head w/ siphon at rated capacity = 7.5 ft. Min. Static Head w/o siphon = 8.25 ft. Min. Static Head w/o siphon 15.25 ft. Dry Season Average = 17.55 ft. at 10.0 ft. suction Net Season Average = 15.64 ft at 10.0 ft suction Add 1.0 ft. for exit loss Add 50 ft for discharge pipe Add 175 ft. for Elbows Add 775 ft. for FSI	TOTAL HEAD (FT)	12.1	12.6	13.1	13.7	14.3	15.0	15.7	16.4	17.2	18.0	18.9	19.7	20.7
ation CFS (336,6%	Max. Static Head w/ siphon = 15. ft. @ 80% rated Head w/ siphon at rated capacity = 7.5 ft. Min. Static Head w/o siphon = 8.25 ft. Min. Static Head w/o siphon 15.25 ft. Dry Season Average = 17.55 ft. at 10.0 ft. suction Wet Season Average = 15.64 ft at 10.0 ft suction Add 1.0 ft. for exit loss Add 50 ft for discharge pipe Add 175 ft. for Elbows Add 775 ft. for FSI	VELOCITY STATIC FRICTION TOTAL HEAD (FT) HEAD (FT)	1.6	1.9	2.1	2.5	2.8	3.1	3.5	3.9	4.3	4.7	5.1	5.6	6.1
oir Pump St. /E 3A - 750 (	ead w/ sipho on at rated co sad w/o sipho ead w/o sipho werage = 17 Average = 18 cexit loss discharge pip r Elbows FSI	STATIC HEAD (FT)	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1
EAA Reservoir Pump Station ALTERNATIVE 3A - 750 CFS	Max. Static Head w/ siphon = 15. ft. @ Head w/ siphon at rated capacity = 7.5 Min. Static Head w/o siphon = 8.25 ft. Max. Static Head w/o siphon 15.25 ft. Dry Season Average = 17.55 ft. at 10. Wet Season Average = 15.64 ft at 10. Add 1.0 ft. for exit loss Add 50 ft for discharge pipe Add 175 ft. for Elbows Add 2.5 ft. for FSI	VELOCITY HEAD (FT)	1.3	1.6	1.8	2.1	2.4	2.7	3.0	3.4	3.8	4.2	4.6	5.0	5.4
		VELOCITY VELOCITY (FT/SEC) HEAD (FT)	9.30	10.08	10.87	11.65	12.44	13.22	14.01	14.80	15.58	16.37	17.15	17.94	18.72
9.14 102 300	100 0.5 236,625 20,000 0.78	CFS	527	572	616	199	705	750	795	839	884	928	973	1017	1062
STATIC HEAD (FT) INSIDE DIAMETER (IN) PIPE LENGTH (FT)	C - FACTOR (100 TO 140) BEND FACTOR (K) BEGINNING GPM GPM INCREMENT SYSTEM EFFICIENCY	GPM	236625	256625	276625	296625	316625	336625	356625	376625	396625	416625	436625	456625	476625
STA INSI	C-I BEN BEG GPN SYS														

South Florida Water Management District **EAA Reservoir A-1 Basis of Design Report** 

								,					
ab de		BRAKE Hp	1068	1342	1495	1659	2025	2229	2447	2680	2929	3194	3477
EAA Reservoir Pump Station ALTERNATIVE 3A - 750 CFS (336,625 GPM) PUMP Max. Static Head w/ siphon = 15. ft. @ 80% rated cap. Head w/ siphon at rated capacity = 7.5 ft. Min. Static Head w/o siphon = 8.25 ft. Max. Static Head w/o siphon 15.25 ft. Dry Season Average = 17.55 ft. at 10.0 ft. suction Wet Season Average = 15.64 ft at 10.0 ft suction Add 1.0 ft. for exit loss		TOTAL HEAD (FT)	13.9	15.0	15.6	16.2	17.5	18.3	19.1	19.9	20.7	21.6	22.5
ation CFS (336,6) on = 15. ft. @ apacity = 7.5 on = 8.25 ft. non 15.25 ft. 5.54 ft at 10.	ed obsess	VELOCITY STATIC FRICTION TOTAL HEAD (FT) HEAD (FT)	6. 6	2.1	2.5	2.8	3.5	3.9	4.3	4.7	5.1	5.6	6.1
oir Pump St VE 3A - 750 lead w/ siphc on at rated c ead w/o siph lead w/o siph werage = 17 Average = 1 Average = 1	discharge pi or Elbows FSI r internal pur	STATIC HEAD (FT)	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
EAA Reservoir Pump Station ALTERNATIVE 3A - 750 CFS (336,625 GPM) Pu Max. Static Head w/ siphon = 15. ft. @ 80% rated Head w/ siphon at rated capacity = 7.5 ft. Min. Static Head w/o siphon = 8.25 ft. Max. Static Head w/o siphon 15.25 ft. Dry Season Average = 17.55 ft. at 10.0 ft. suction Wet Season Average = 15.64 ft at 10.0 ft suction Add 1.0 ft. for exit loss	Add 50 ft for discharge pipe Add 175 ft. for Elbows Add 75 ft. for FSI Add 2.5 ft. for internal pump losses		6. 4	5. 6.	2.1	2.4	3.0	3.4	3.8	4.2	4.6	5.0	5.4
		VELOCITY (FT/SEC)	9.30	10.87	11.65	12.44	14.01	14.80	15.58	16.37	17.15	17.94	18.72
11 102 300 100 0.5 236,625 20,000 0.78		CFS	527	616	661	705	795	839	884	928	973	1017	1062
STATIC HEAD (FT) INSIDE DIAMETER (IN) PIPE LENGTH (FT) C - FACTOR (100 TO 140) BEND FACTOR (K) BEGINNING GPM GPM INCREMENT SYSTEM EFFICIENCY		GPM	236625	276625	296625	316625	356625	376625	396625	416625	436625	456625	476625

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South Florida Water Management District **EAA Reservoir A-1 Basis of Design Report** 

Proporti propins sense successoria propins propins propins L. C.	BRAKE	1111 1265 1427 1597 176 1964 2163 2374 2596	3079 3342 3619
Some stated of the state of the	TOTAL HEAD (FT)	20.3 20.6 21.1 22.0 23.1 23.1 23.7 24.3	25.0 25.8 26.5 27.3
ation CFS (336,62 Dn = 15. ft. @ apacity = 7.5 On = 8.25 ft. Don 15.25 ft. at 10.( 5.64 ft at 10.( pe	STATIC FRICTION TOTAL HEAD (FT) HEAD (FT)	0.8 1.1.3 1.2.3 2.3 2.3 2.3 3.0 2.3	2.6.4. 4.7.1.
Pump St 3A - 750 ad w/siphc at rated o d w/o siph ad w/o siph ad w/o siph ad w/o siph ad w/o siph arage = 17 erage = 1 xit loss xit loss scharage pi sicharage pi	STATIC HEAD (FT)	6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6	2. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8.
EAA Reservoir Pump Station ALTERNATIVE 3A - 750 CFS (336,625 GPM) PUMP Max. Static Head w/ siphon = 15. ft. @ 80% rated cap. Head w/ siphon at rated capacity = 7.5 ft. Min. Static Head w/o siphon 15.25 ft. Max. Static Head w/o siphon 15.25 ft. Dry Season Average = 17.55 ft. at 10.0 ft. suction Wet Season Average = 15.64 ft at 10.0 ft suction Add 1.0 ft. for exit loss Add 50 ft for discharge pipe Add 175 ft. for Elbows Add 75 ft. for FSI Add 2.5 ft. for internal pump losses	VELOCITY HEAD (FT)	7.007 + + + + 000	2.8.8.4. 2.6.0.4.
	VELOCITY (FT/SEC)	6.65 7.44 8.22 9.01 9.79 11.36 12.15	13.72 14.51 15.29 16.08
18.75 102 300 100 0.5 169,300 20,000	CFS	377 422 466 511 555 600 645 689 734	923 867 912
STATIC HEAD (FT) INSIDE DIAMETER (IN) PIPE LENGTH (FT) C - FACTOR (100 TO 140) BEND FACTOR (K) BEGINNING GPM GPM INCREMENT SYSTEM EFFICIENCY	GPM	169300 189300 209300 229300 249300 269300 309300 329300	349300 369300 389300 409300

<u> </u>	BRAKE Hp	1098	1250	1410	1578	1755	1942	2140	2349	2569	2803	3049	3310	3586
EAA Reservoir Pump Station ALTERNATIVE 3A - 750 CFS (336,625 GPM) PUMP Max. Static Head w/ siphon = 15. ft. @ 80% rated cap. Head w/ siphon at rated capacity = 7.5 ft. Min. Static Head w/o siphon 15.25 ft. Max. Static Head w/o siphon 15.25 ft. Dry Season Average = 17.55 ft. at 10.0 ft. suction Wet Season Average = 15.64 ft at 10.0 ft suction Add 1.0 ft. for exit loss Add 50 ft for discharge pipe Add 175 ft. for Elbows Add 75 ft. for FSI Add 2.5 ft. for internal pump losses	TOTAL IEAD (FT)	20.0	20.4	20.8	21.3	21.8	22.3	22.8	23.5	24.1	24.8	25.5	26.3	27.1
ALTERNATIVE 3A - 750 CFS (336,625 GPM) PIALTERNATIVE 3A - 750 CFS (336,625 GPM) PIAS. Static Head w/ siphon = 15. ft. @ 80% rated Head w/ siphon at rated capacity = 7.5 ft. Win. Static Head w/o siphon 15.25 ft. Wax. Static Head w/o siphon 15.25 ft. Dry Season Average = 17.55 ft. at 10.0 ft. suction Wet Season Average = 15.64 ft at 10.0 ft suction Add 1.0 ft. for exit loss Add 50 ft for discharge pipe Add 175 ft. for Elbows Add 775 ft. for FSI	STATIC FRICTION TOTAL HEAD (FT) HEAD (FT)	0.8	1.0	1.3	1.5	1.8	2.0	2.3	2.7	3.0	3.4	3.7	4.1	4.5
ALTERNATIVE 3A - 750 CFS (336,6 Max. Static Head w/ siphon = 15. ft. (Head w/ siphon = 15. ft. (Head w/ siphon = 8.25 ft. Max. Static Head w/o siphon = 8.25 ft. Max. Static Head w/o siphon 15.25 ft. Dry Season Average = 17.55 ft. at 10 Wet Season Average = 15.64 ft at 10 Add 1.0 ft. for discharge pipe Add 50 ft for discharge pipe Add 75 ft. for Elbows Add 75 ft. for Elbows Add 2.5 ft. for internal pump losses	STATIC HEAD (FT)	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5
ALTERNATIVE 3A - 750 CFS ALTERNATIVE 3A - 750 CFS Max. Static Head w/ siphon = 1 Head w/ siphon at rated capaco Min. Static Head w/o siphon 1 Dry Season Average = 17.55 ft Wet Season Average = 17.55 ft Wet Season Average = 15.64 ft Add 1.0 ft. for exit loss Add 50 ft for discharge pipe Add 175 ft. for Elbows Add 25 ft. for FSI Add 2.5 ft. for internal pump lo	VELOCITY HEAD (FT)	0.7	0.9	1.0	1.3	1.5	1.7	2.0	2.3	2.6	2.9	3.3	3.6	4.0
	VELOCITY (FT/SEC)	6.65	7.44	8.22	9.01	9.79	10.58	11.36	12.15	12.94	13.72	14.51	15.29	16.08
18.5 102 300 100 0.5 169,300 20,000 0.78	CFS	377	422	466	511	555	009	645	689	734	778	823	867	912
STATIC HEAD (FT) INSIDE DIAMETER (IN) PIPE LENGTH (FT) C - FACTOR (100 TO 140) BEND FACTOR (K) BEGINNING GPM GPM INCREMENT SYSTEM EFFICIENCY	GPM	169300	189300	209300	229300	249300	269300	289300	309300	329300	349300	369300	389300	409300

South Florida Water Management District **EAA Reservoir A-1 Basis of Design Report** 

	BRAKE Hp 625 732 849 978 1119 1119 1234 1838 2061 2304 2567
EAA Reservoir Pump Station ALTERNATIVE 4A - 600 CFS (269,300 GPM) PUMP Max. Static Head = 15.0 ft. @ 80% capacity Head at Rated Capacity = 7.75 Min. Static Head = 1.75 ft. Wet Season Average = 15.64 ft. at 10.0 ft. suction Dry Season Average = 17.55 ft at 10.0 ft. suction Add 25 ft. for bell entrance Add 25 ft. for bell entrance Add 20 ft. for discharge pipe Add 1.0 ft. for exit loss.	TOTAL HEAD (FT) 11.4 11.9 12.5 13.2 13.2 13.2 13.2 13.2 13.2 13.2 13.2
EAA Reservoir Pump Station ALTERNATIVE 4A - 600 CFS (269,300 GPM) PU Max. Static Head = 15.0 ft. @ 80% capacity Head at Rated Capacity = 7.75 Min. Static Head = 1.75 ft. Wet Season Average = 15.64 ft. at 10.0 ft. suction Dry Season Average = 17.55 ft at 10.0 ft. suction Add 25 ft. for bell entrance Add 25 ft. for bell entrance Add 1.0 ft. for exit loss.	Add 100 ft. for elbow Add 2.5 ft. to static head for internal pump losses.  VELOCITY STATIC FRICTION TOTAL HEAD (FT) HEAD (FT) HEAD (FT) 1.4 9.3 1.0 11. 1.7 9.3 1.3 1.1 1.7 9.3 1.5 12. 2.1 9.3 2.2 13. 2.5 9.3 2.2 14. 3.8 9.3 2.9 15. 3.8 9.3 3.7 17. 4.8 9.3 3.7 17. 4.8 9.3 4.2 18. 5.4 9.3 6.0 9.3 5.1 20. 6.6 9.3 5.1 20.
ir Pump Stat E 4A - 600 C E 4A - 600 C sad = 15.0 ft. I Capacity = 7 ad = 1.75 ft. werage = 15. verage = 17.5 bell entrance discharge pip exit loss.	static head for STATIC HEAD (FT) 9.3 9.3 9.3 9.3 9.3 9.3 9.3 9.3 9.3 9.3
EAA Reservoir Pump Station ALTERNATIVE 4A - 600 CFS  Max. Static Head = 15.0 ft. @ Head at Rated Capacity = 7.75 Min. Static Head = 1.75 ft.  Wet Season Average = 15.64 f Dry Season Average = 17.55 ft Add 25 ft. for bell entrance Add 25 ft. for discharge pipe Add 1.0 ft. for exit loss.	Add 100 ft. for elbow Add 2.5 ft. to static hr VELOCITY STAT HEAD (FT) HEAD 1.7 2.1 2.9 3.3 3.8 4.3 4.8 6.0 6.0
ž - v -	VELOCITY (FT/SEC) 8.54 9.55 10.56 11.57 12.58 13.59 14.60 15.61 16.62 17.62 17.62 18.63 19.64
9.25 90 150 100 0.5 169,300 20,000 0.78	CFS 377 422 466 511 555 600 645 689 778 823 867
STATIC HEAD (FT) 9.25 INSIDE DIAMETER (IN) 90 PIPE LENGTH (FT) 150 C - FACTOR (100 TO 140) 100 BEND FACTOR (K) 0.5 BEGINNING GPM 169,300 GPM INCREMENT 20,000 SYSTEM EFFICIENCY 0.78	GPM 169300 189300 229300 229300 249300 329300 329300 329300 329300 329300 329300 369300 369300 409300

South Florida Water Management District **EAA Reservoir A-1 Basis of Design Report** 

						BRAKE	Н	779	903	1038	1185	1345	1520	1709	1914	2137	2378	2639	2920	3223
EAA Reservoir Pump Station ALTERNATIVE 4A - 600 CFS (269,300 GPM) PUMP	acity		ft. suction	t. suction	np losses.	TOTAL	HEAD (FT)	14.2	14.7	15.3	16.0	16.7	4.71	18.2	19.1	20.0	21.0	22.1	23.2	24.3
tion :FS (269,300	Max. Static Head = 15.0 ft. @ 80% capacity	7.75	Min. Static Head = 1.75 ft. Wet Season Average = 15.64 ft. at 10.0 ft. suction	Dry Season Average = 17.55 ft at 10.0 ft. suction	Add 25 ft. for bell entrance Add 25 ft. for discharge pipe Add 1 ft. to static head for exit loss. Add 100 ft. for elbow Add 2.5 ft. to static head for internal pump losses.	FRICTION	HEAD (FT)	1.0	1.3	1.5	1.8	2.2	2.5	2.9	3.3	3.7	4.2	4.6	5.1	5.6
ir Pump Sta E 4A - 600 C	ad = 15.0 ft	Capacity =	ad = 1./5 π. \verage = 15	verage = 17.	bell entrance discharge pic atic head for r elbow static head fo	STATIC	HEAD (FT)	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1
EAA Reservoir Pump Station ALTERNATIVE 4A - 600 CFS	Aax. Static He	Head at Rated Capacity = 7.75	Min. Static Head = 1.75 ft. Wet Season Average = 15	Ory Season A	Add 25 ft. for bell entrance Add 25 ft. for discharge pipe Add 1 ft. to static head for exit loss. Add 100 ft. for elbow Add 2.5 ft. to static head for interna	VELOCITY	HEAD (FT)	1.	4.1	1.7	2.1	2.5	2.9	3.3	3.8	4.3	4.8	5.4	0.9	9.9
	~		< >	_	4444	VELOCITY	(FT/SEC)	8.54	9.55	10.56	11.57	12.58	13.59	14.60	15.61	16.62	17.62	18.63	19.64	20.65
12.05	100	0.5	169,300	0.78			CFS	377	422	466	511	555	009	645	689	734	778	823	867	912
STATIC HEAD (FT) INSIDE DIAMETER (IN) PIPE I ENGTH (FT)	C - FACTOR (100 TO 140)	BEND FACTOR (K)	BEGINNING GPM GPM INCREMENT	SYSTEM EFFICIENCY			GPM	169300	189300	209300	229300	249300	269300	289300	309300	329300	349300	369300	389300	409300

South Florida Water Management District EAA Reservoir A-1 Basis of Design Report

		BRAKE Hp	629	751	888	1042	1407	1622	1859	2121	2408	2724	3068	3442
acity ft. suction suction	p losses.	TOTAL HEAD (FT)	11.5	12.2	13.1	14.0	16.1	17.3	18.6	19.9	21.3	22.8	24.3	26.0
EAA Reservoir Pump Station ALTERNATIVE 4 - 600 CFS (269,300 GPM) PUMP Max. Static Head = 15.0 ft. @ 80% capacity Head at Rated Capacity = 7.75 Min. Static Head = 1.75 ft. Wet Season Average = 15.64 ft. at 10.0 ft. suction Dry Season Average = 17.55 ft at 10.0 ft. suction Add 25 ft. for bell entrance	Add 25 ft. for discharge pipe Add 350 ft. for flap valve. Add 100 ft. for elbow Add 2.5 ft. to static head for internal pump losses.	FRICTION HEAD (FT)	2.1	2.6	3.1	3.7	2.0	5.8	6.5	7.4	8.2	9.1	10.1	11.1
ir Pump Star E 4 - 600 CF and = 15.0 ft A Capacity = 7 and = 1.75 ft. Werage = 15.	discharge pip r flap valve. r elbow static head fo	STATIC HEAD (FT)	8.3	8.3	8.3	ω α 	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
ALTERNATIVE 4 - 600 CFS (SMax. Static Head = 15.0 ft. @Head at Rated Capacity = 7.75 Min. Static Head = 1.75 ft. Wet Season Average = 15.64 ft. Dry Season Average = 17.55 ft. Add 25 ft. for bell entrance	Add 25 ft. for discharge pipe Add 350 ft. for flap valve. Add 100 ft. for elbow Add 2.5 ft. to static head for	VELOCITY HEAD (FT)	7:	1.4	1.7	2.1	2.9	3.3	3.8	4.3	4.8	5.4	6.0	9.9
		VELOCITY (FT/SEC)	8.54	9.55	10.56	17.57	13.59	14.60	15.61	16.62	17.62	18.63	19.64	20.65
8.25 90 500 100 0.5 169,300 20,000		CFS	377	422	466	511	009	645	689	734	778	823	867	912
C HEAD (FT) E DIAMETER (IN) ENGTH (FT) CTOR (100 TO 140) FACTOR (K) INING GPM NCREMENT EM EFFICIENCY		GPM	169300	189300	209300	229300	269300	289300	309300	329300	349300	369300	389300	409300

South Florida Water Management District EAA Reservoir A-1 Basis of Design Report

) PUMP	uction	sses.	B	HEAD (FT) Hp	14.3 782	15.0 922	-		17.8 1441	18.9 1651				24.1 2725		
EAA Reservoir Pump Station ALTERNATIVE 4 - 600 CFS (269,300 GPM) PUMP	Max. Static Head = 15.0 ft. @ 80% capacity Head at Rated Capacity = 7.75 Min. Static Head = 1.75 ft. Wet Season Average = 15.64 ft. at 10.0 ft. suction Dry Season Average = 17.55 ft at 10.0 ft. suction	Add 25 ft. for bell entrance Add 25 ft. for discharge pipe Add 350 ft. for flap valve. Add 100 ft. for elbow Add 2.5 ft. to static head for internal pump losses.		HEAD (FI) HEA	2.1	2.6	3.1	3.7	4.3	5.0	5.8	6.5	7.4	8.2	9.1	101
ir Pump Sta E 4 - 600 Cl	ad = 15.0 f 1 Capacity = ad = 1.75 ft werage = 15 verage = 17	bell entrance discharge pij flap valve. elbow static head fo	STATIC	HEAD (FI)	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	111
EAA Reservoir Pump Station ALTERNATIVE 4 - 600 CFS (	Max. Static Head = 15.0 ft. @ Head at Rated Capacity = 7.75 Min. Static Head = 1.75 ft. Wet Season Average = 15.64 ft. Dry Season Average = 17.55 ft.	Add 25 ft. for bell entrance Add 25 ft. for discharge pipe Add 350 ft. for flap valve. Add 100 ft. for elbow Add 2.5 ft. to static head for	VELOCITY	HEAD (F1)	1.1	1.4	1.7	2.1	2.5	2.9	3.3	3.8	4.3	4.8	5.4	9
	21270	4444	VELOCITY	(F1/3EC)	8.54	9.55	10.56	11.57	12.58	13.59	14.60	15.61	16.62	17.62	18.63	19.64
11.05	100 0.5 169,300 20,000 0.78		Ğ	5	377	422	466	511	222	900	645	689	734	778	823	867
; HEAD (FT) DIAMETER (IN) ENGTH (FT)	TOR (100 TO 140) ACTOR (K) NING GPM ICREMENT M EFFICIENCY		NGO	N N	169300	189300	209300	229300	249300	269300	289300	309300	329300	349300	369300	389300

South Florida Water Management District **EAA Reservoir A-1 Basis of Design Report** 

							BRAKE	운	738	873	1023	1190	1376	1582	1809	2059	2334	2635	2963	3320	3707	
SPM) PUMP	acity	ft. suction	. suction			np losses.	TOTAL	HEAD (FT)	13.5	14.2	15.1	16.0	17.0	18.1	19.3	20.6	21.9	23.3	24.8	26.3	28.0	
EAA Reservoir Pump Station ALTERNATIVE 4 - 600 CFS (269,300 GPM) PUMP	Max. Static Head = 15.0 ft. @ 80% capacity Head at Rated Capacity = 7.75	Min. Static Head = 1.75 ft. Wet Season Average = 15.64 ft. at 10.0 ft. suction	Dry Season Average = 17.55 ft at 10.0 ft. suction	9	D.	Add 2.5 ft. to static head for internal pump losses.	FRICTION	HEAD (FT)	2.1	2.6	3.1	3.7	4.3	2.0	5.8	6.5	7.4	8.2	9.1	10.1	11.1	
ir Pump Sta E 4 - 600 CF	ad = 15.0 ft	ad = 1.75 ft. \verage = 15	verage = 17.	bell entrance	flap valve.	static head fo	STATIC	HEAD (FT)	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	
EAA Reservoir Pump Station ALTERNATIVE 4 - 600 CFS (	Max. Static Head = 15.0 ft. @ Head at Rated Capacity = 7.75	Min. Static Head = 1.75 ft. Wet Season Average = 15	ory Season A	Add 25 ft. for bell entrance	Add 350 ft. for flap valve. Add 100 ft. for elbow	Add 2.5 ft. to	VELOCITY	HEAD (FT)	1.1	1.4	1.7	2.1	2.5	2.9	3.3	3.8	4.3	4.8	5.4	0.9	9.9	
-	2		_			`	VELOCITY	(FT/SEC)	8.54	9.55	10.56	11.57	12.58	13.59	14.60	15.61	16.62	17.62	18.63	19.64	20.65	
10.25	0.5	169,300 20,000	0.78					CFS	377	422	466	511	222	900	645	689	734	778	823	867	912	
C HEAD (FT) E DIAMETER (IN) FNGTH (FT)	CTOR (100 TO 140) FACTOR (K)	INING GPM NCREMENT	EM EFFICIENCY					GPM	169300	189300	209300	229300	249300	269300	289300	309300	329300	349300	369300	389300	409300	

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South Florida Water Management District **EAA Reservoir A-1 Basis of Design Report** 

			BRAKE	운	735	854	984	1126	1281	1450	1634	1834	2052	2288	2543	2819	3117
EAA Reservoir Pump Station ALTERNATIVE 4A - 600 CFS (269,300 GPM) PUMP	acity ft. suction t. suction	np losses.	TOTAL	HEAD (FT)	13.4	13.9	14.5	15.2	15.9	16.6	17.4	18.3	19.2	20.2	21.3	22.4	23.5
tion :FS (269,300	Max. Static Head = 15.0 ft. @ 80% capacity Head at Rated Capacity = 7.75 Min. Static Head = 1.75 ft. Wet Season Average = 15.64 ft. at 10.0 ft. suction Dry Season Average = 17.55 ft at 10.0 ft. suction	Add 25 ft. for bell entrance Add 25 ft. for discharge pipe Add 1.0 ft. for exit loss. Add 100 ft. for elbow Add 2.5 ft. to static head for internal pump losses.	FRICTION	HEAD (FT)	1.0	1.3	1.5	1.8	2.2	2.5	2.9	3.3	3.7	4.2	4.6	5.1	5.6
ir Pump Star E 4A - 600 C	ad = 15.0 ft 1 Capacity = 1 ad = 1.75 ft. werage = 15.	bell entrance discharge pip exit loss. r elbow static head fo	STATIC	HEAD (FT)	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3
EAA Reservoir Pump Station ALTERNATIVE 4A - 600 CFS	Max. Static Head = 15.0 ft. @ Head at Rated Capacity = 7.75 Min. Static Head = 1.75 ft. Wet Season Average = 15.64 ft. Dry Season Average = 17.55 ft.	Add 25 ft. for bell entrance Add 25 ft. for discharge pipe Add 1.0 ft. for exit loss. Add 100 ft. for elbow Add 2.5 ft. to static head for i	VELOCITY	HEAD (FT)	1.	1.4	1.7	2.1	2.5	2.9	3.3	3.8	4.3	4.8	5.4	0.9	9.9
шч	212>0	4444	VELOCITY	(FT/SEC)	8.54	9.55	10.56	11.57	12.58	13.59	14.60	15.61	16.62	17.62	18.63	19.64	20.65
11.25 90 150	100 0.5 169,300 20,000 0.78			CFS	377	422	466	511	555	900	645	689	734	778	823	867	912
EAD (FT) AMETER (IN) GTH (FT)	DR (100 TO 140) STOR (K) 4G GPM REMENT EFFICIENCY			GPM	169300	189300	209300	229300	249300	269300	289300	309300	329300	349300	369300	389300	409300

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South Florida Water Management District EAA Reservoir A-1 Basis of Design Report

July, 2005

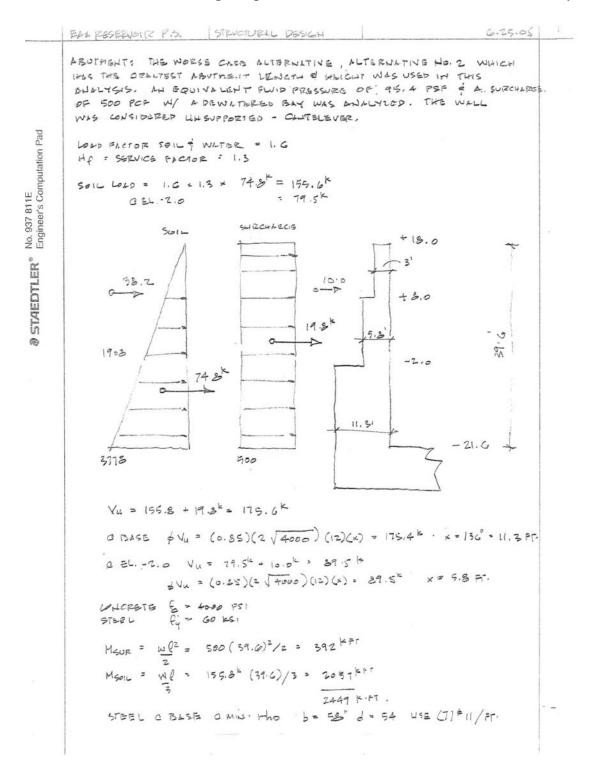
										BRAKE	712	829	1018	1190	1376	1578	1798	2037	2296	2577	2881	3211	3567
PUMP	acity			ft. suction	. suction				np losses.	TOTAL HEAD (FT)	19.0	19.6	20.2	21.0	21.7	22.6	23.6	24.6	25.7	56.9	28.2	29.6	31.0
ion S (269,300 G	@ 80% capa	6/:		64 ft. at 10.0	55 ft at 10.0 ft		Ф		r internal pun	FRICTION HEAD (FT)	1.0	1.4	1.8	2.2	2.7	3.3	3.9	4.5	5.2	0.9	8.9	9.7	8.5
r Pump Stat E 4 - 600 CF	ad = 15.0 ft.	Capacity = /	ad = 1.75 ft.	verage = 15.	/erage = 17.5	sell entrance	lischarge pip	flap valve.	elbow tatic head fo	STATIC HEAD (FT)	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5
EAA Reservoir Pump Station ALTERNATIVE 4 - 600 CFS (269,300 GPM) PUMP	Max. Static Head = 15.0 ft. @ 80% capacity	Head at Rated Capacity = 7.75	Min. Static Head = 1.75 ft.	Wet Season Average = 15.64 ft. at 10.0 ft. suction	Dry Season Average = 17.55 ft at 10.0 ft. suction	Add 25 ft. for bell entrance	Add 25 ft. for discharge pipe	Add 350 ft. for flap valve.	Add 100 ft. for elbow Add 2.5 ft. to static head for internal pump losses.	VELOCITY HEAD (FT)	0.5	0.7	1.0	1.2	1.5	1.8	2.2	2.6	3.0	3.5	3.9	4.4	2.0
ш«	2.			>		•	•	•		VELOCITY (FT/SEC)	5.82	6.83	7.84	8.85	9.86	10.87	11.88	12.89	13.90	14.91	15.92	16.93	17.93
90 500	100	0.5	115,440	20,000	0.78					CFS	257	302	346	391	435	480	525	999	614	658	703	747	792
STATIC HEAD (FT) INSIDE DIAMETER (IN) PIPE I ENGTH (FT)	C - FACTOR (100 TO 140)	BEND FACTOR (K)	BEGINNING GPM	GPM INCREMENT	SYSTEM EFFICIENCY					GPM	115440	135440	155440	175440	195440	215440	235440	255440	275440	295440	315440	335440	355440

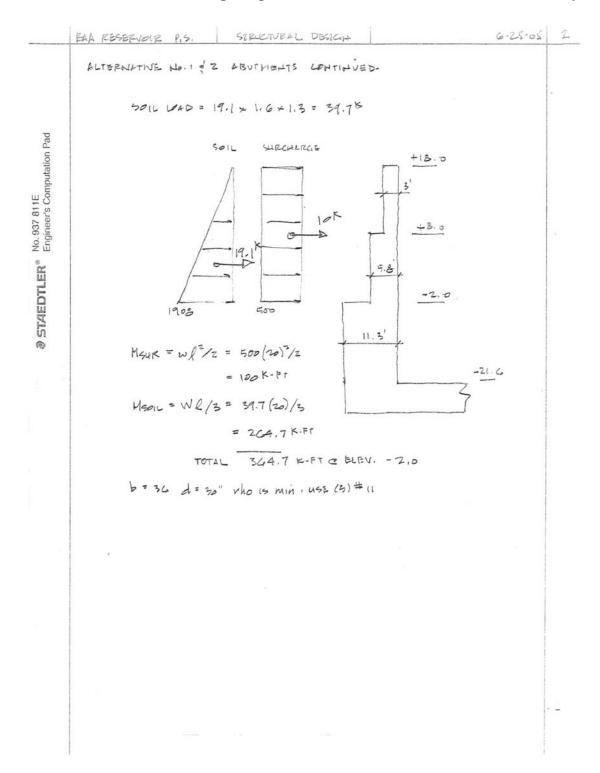
South Florida Water Management District EAA Reservoir A-1 Basis of Design Report

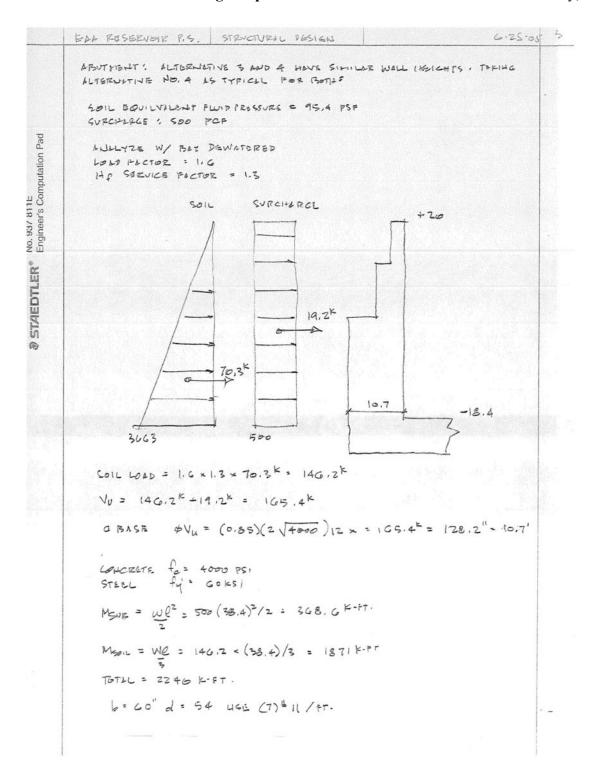
									BRAKE	운	729	872	1023	1182	1352	1532	1725	1931	2151	2387	2639	2909	3198
	EAA Reservoir Pump Station ALTERNATIVE 4A - 600 CFS (269,300 GPM) PUMP	acity		ft. suction t. suction				np losses.	TOTAL	HEAD (FT)	19.5	19.9	20.3	20.8	21.4	22.0	22.6	23.3	24.1	25.0	25.8	26.8	27.8
	tion :FS (269,300	. @ 80% cap; 7.75		.64 ft. at 10.0 55 ft at 10.0 ft		æ		ır internal pun	FRICTION	HEAD (FT)	0.5	0.7	6.0	1.1	1.4	1.6	1.9	2.3	2.6	3.0	3.4	3.8	4.3
	ir Pump Sta E 4A - 600 C	Capacity = 7	ad = 1.75 ft.	verage = 15.	ell entrance	lischarge pip	exit loss.	elbow static head fo	STATIC	HEAD (FT)	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5
	EAA Reservoir Pump Station ALTERNATIVE 4A - 600 CFS	Max. Static Head = 15.0 ft. @ 80% capacity Head at Rated Capacity = 7.75	Min. Static Head = 1.75 ft.	Wet Season Average = 15.64 ft. at 10.0 ft. suction Dry Season Average = 17.55 ft at 10.0 ft. suction	Add 25 ft for hell entrance	Add 25 ft. for discharge pipe	Add 1.0 ft. for exit loss	Add 2.5 ft. to static head for internal pump losses.	VELOCITY	HEAD (FT)	0.5	0.7	1.0	1.2	1.5	1.8	2.2	2.6	3.0	3.5	3.9	4.4	5.0
^		2 1	. ~	> 4	1	. ~	•		VELOCITY	(FT/SEC)	5.82	6.83	7.84	8.85	986	10.87	11.88	12.89	13.90	14.91	15.92	16.93	17.93
MAX. UELD	18.5	100	115,440	20,000						CFS	257	302	346	391	435	480	525	999	614	658	703	747	792
MAK	STATIC HEAD (FT) INSIDE DIAMETER (IN) PIPE LENGTH (FT)	C - FACTOR (100 TO 140)	BEGINNING GPM	GPM INCREMENT SYSTEM EFFICIENCY						В	115440	135440	155440	175440	195440	215440	235440	255440	275440	295440	315440	335440	355440

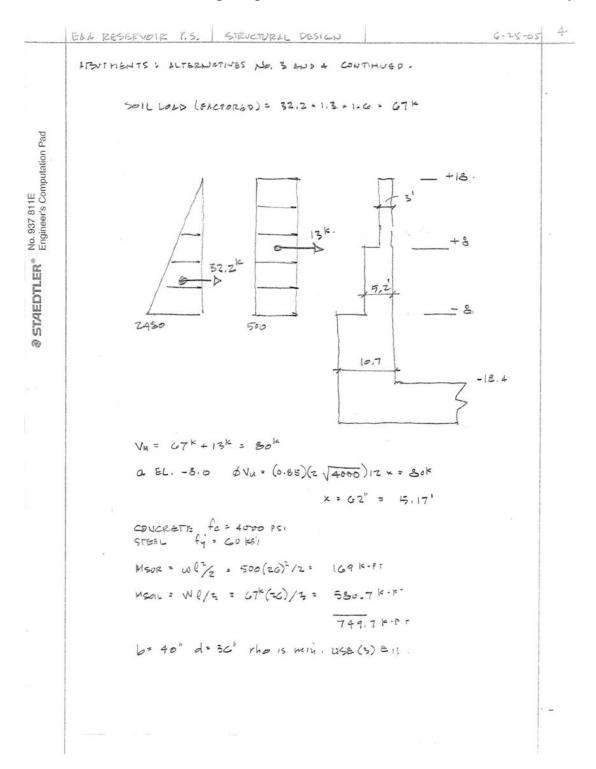
July, 2005

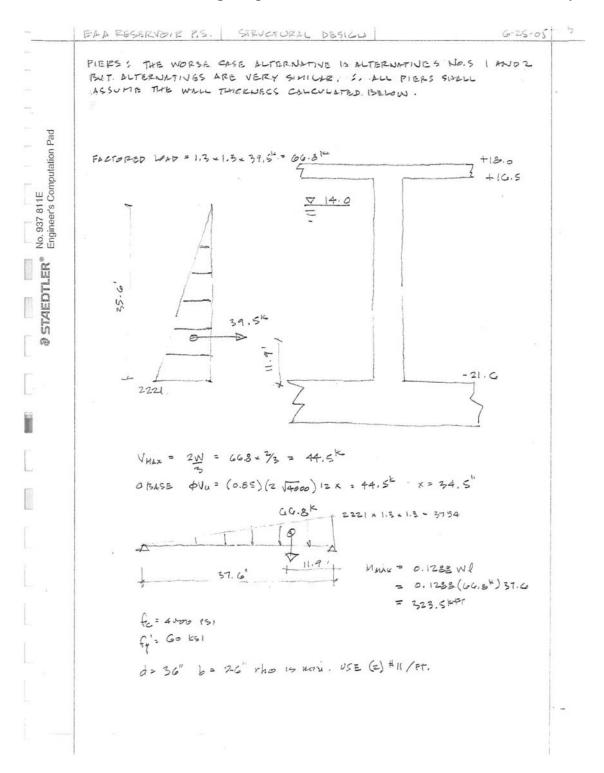
REINFORCED CONCRETE HAND CALCULATIONS

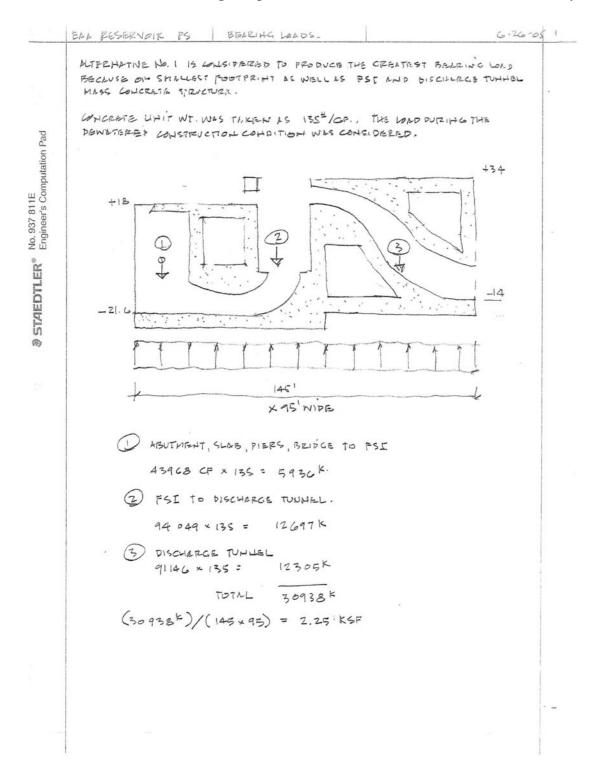


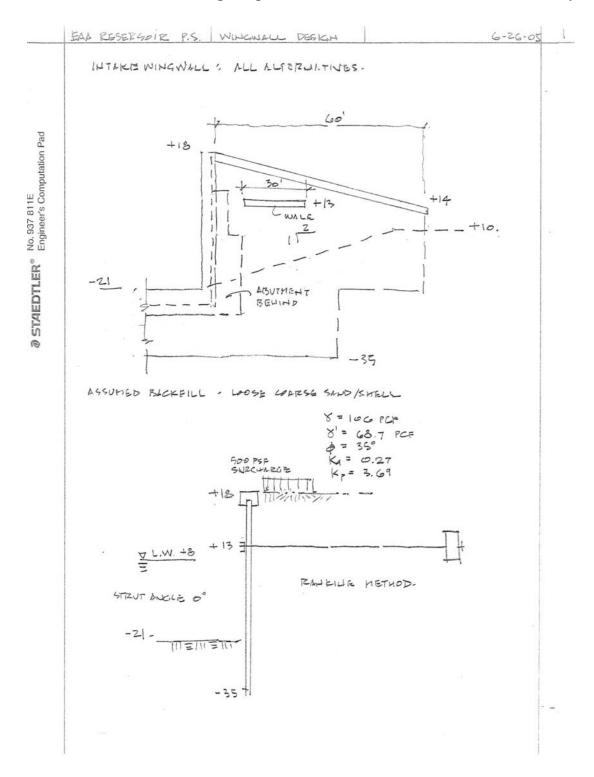


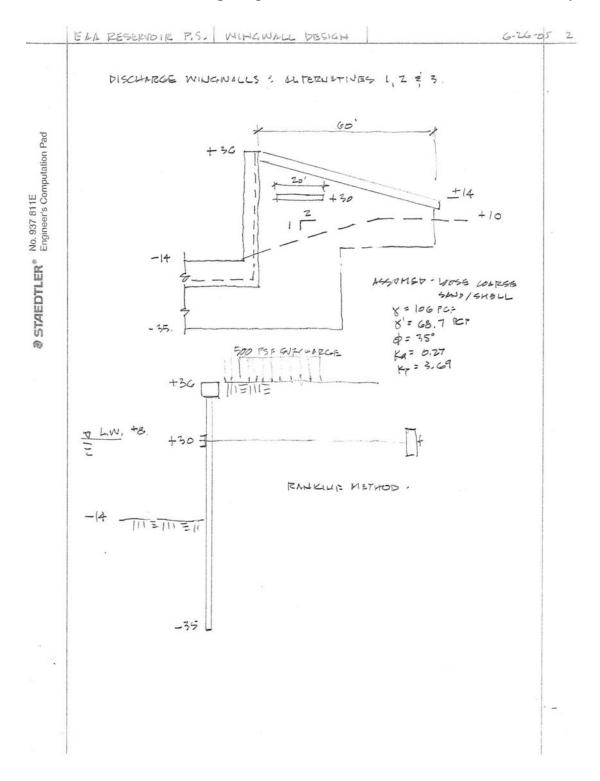


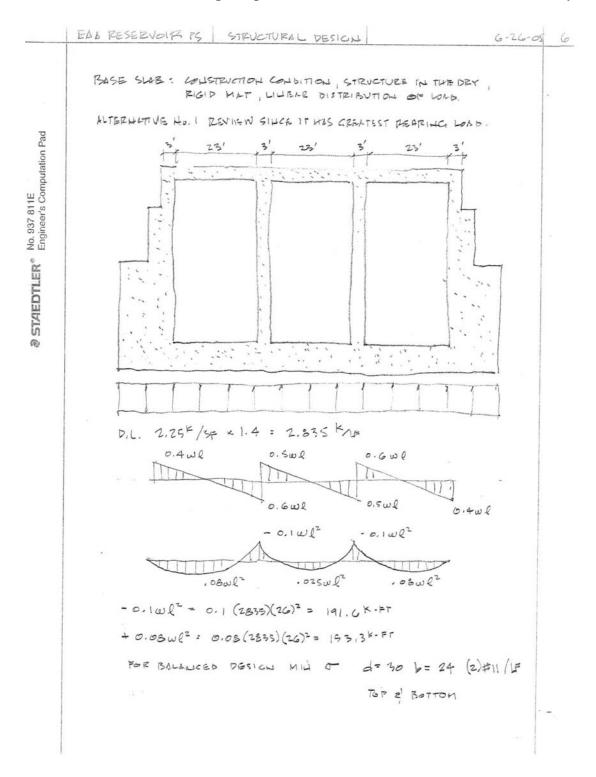












July, 2005

### **COST ESTIMATES**

# South Florida Water Management District **EAA Reservoir A-1 Basis of Design Report**

EA	EAA RESERVOIR PUMP STA		ALTER	NAT	IVE No.	1	
(3)	1000 cfs Vertical Pumps w/ FSI						7/2/2005
Iten	n Description	Unit	Quantity	Un	it Cost		Total
OVI	ERHEAD						
	Bonds	LS	job	\$	130,000	\$	130,000
	Builders Risk	LS	job	\$	70,000	\$	70,000
	Licenses	LS	job	\$	10,000	\$	10,000
	Insurance	LS	job	\$	100,000	\$	100,000
	Owner's Offices	mn	24	\$	4,000	\$	96,000
	Contractor's Offices	mn	24	\$	4,000	\$	96,000
	Utilities	mn	24	\$	3,000	\$	72,000
	Quality Control Testing	LS	job	\$	80,000	\$	80,000
	Engineering Consultant	LS	job	\$	50,000	\$	50,000
	Scheduling Consultant	mn	24	\$	3,500	\$	84,000
	Administration Staff	mn	24	\$	40,000	\$	960,000
	Field Engineering and Survey	LS	job	\$	60,000	\$	60,000
	Subtotal					\$	1,808,000
DE	WATERING						
1	Cofferdam 150 ft. x 100 ft., instal	I and rem	iove				
	el. +14 to -36, 50 ft./PZ35 sht.	ton	438	\$	1,600	\$	700,800
	Bracing and tie-back system	LS	job	\$	300,000	\$	300,000
	Pumping	mn	9	\$	10,000	\$	90,000
	Detention Basin	LS	job	\$	20,000	\$	20,000
2	Excavation	су	25000	\$	5	\$	125,000
	Subtotal					\$	1,235,800
STE	RUCTURE (Installed costs UON)	1					
1	Reinforced Concrete w/ Embeds						
	Intake Base Slab	су	2097	\$	400	\$	838,800
	Intake Abutments	су	1223	\$	400	\$	489,200
	FSI to Operating Floor	су	2822	\$	600	\$	1,693,200
	Pump Embeds	LS	job	\$	15,000	\$	15,000
	Intake Piers	су	1933	\$	400	\$	773,200
	Service Bridge	су	82	\$	500	\$	41,000
	Approach Slabs	су	60	\$	400	\$	24,000
	FI'r Slab Embeds/Cover Plates	LS	job	\$	20,000	\$	20,000
	Opérating Floor Slab Beams	су	60	\$	500	\$	30,000
	Discharge Tunnel to Oper. Fl'r.	су	2446	\$	600	\$	1,467,600
	Intake Noses	су	20	\$	600	\$	12,000
	Tank Slab	су	40	\$	400	\$	16,000
	Exterior Fuel Trench w/ cover	LS	iob	\$	15,000	\$	15,000
	Service water intake	CY	140	\$	500	\$	70,000
	Interior fuel trench w/ grating	LS	job	\$	7,000	\$	7,000
	Bulkhead Slot Embeds	LS	job	\$	25,000	\$	25,000
	Gates Slot/Sill Embeds	LS	job	\$	30,000	\$	30,000
	Pump Support Ring	LS	iob	\$	15,000	\$	15,000
	Miscel. Access ladders	ea	2	\$	3,500	\$	7,000

2	Pipe Gallery Hatches Equipment Slabs Total	LS						
2	Equipment Slabs	LS						
2	Equipment Slabs	-	iob	\$	3,000	\$	3.000	
2		СУ	25	\$	500	DESCRIPTION OF D	12,500	
2		-,	10950					
-	Pump House 80 ft. x 95 ft. w/ 46 ft	t naran						
	Precast Panel w/ embeds	sf	16100	\$	23	\$	370,300	
	Steel Frame	LS	job	s	140.000	S	140,000	
	Bridge Crane haunches/girders	LS	iob	\$	30,000	S	30,000	
	Double Tee Precast Roof	sf	7600	\$	25	S	190,000	
	Roof Covering	SQ	76	\$	500	\$	38,000	
	마이와 (1 스웨터) 1년(10년) 경우(16)(11) 수는 프랑 (리티티)에 돌아하는 (프리그는 11) 11 등 12 등 1	LS	iob	S	15.000	S	15,000	
	Miscel. Sealants, etc		105	S	550	\$	57,750	
	Control Rm. Slab/Walls/Beams	cy LS	iob	\$	3,500	\$	3,500	
	Control Rm. Stairs			\$		Legis College of		
	Wheel chair lift	ea	1 ich		20,000	\$	20,000 8.000	
	Control Rm. Viewing Windows	LS	job	\$	8,000	100	4.500	
	Restroom Fixtures	LS	job	\$	4,500	\$		
	Break Room Fixtures	LS	job	\$	5,000	\$	5,000	
	Counters, cabinets	LS	job	\$	8,500	\$	8,500	
	Overhead doors w/ storm bars	ea	2	\$	13,000	\$	26,000	
	Doors and hardware	ea	6	\$	3,500	\$	21,000	
	Interior drywall, flooring etc.	LS	job	\$	10,000	\$	7,500	
	Specialties, i.e. lockers	LS	job	\$	15,000	\$	15,000	
	Access manway	ea	3	\$	4,500	\$	13,500	
	Ladder w/ roof hatch	ea	1	\$	10,000	\$	10,000	
4	Miscellaneous							
	Grating, embeds, steel support	sf	700	\$	45	\$	31,500	
	Miscel. Embeds	LS	job	\$	10,000	\$	10,000	
	Handrail	If	150	\$	35	\$	5,250	
5	Trash Rack							
	Rack, 42 x 23 sst	ea	3	\$	65,000	\$	195,000	
	Supports and Embeds	ea	3	\$	25,000	\$	75,000	
	Rack 10 x 12 service water	ea	1	\$	20,000	\$	20,000	
6	Coatings							
	Exterior exposed concrete	LS	job	\$	27,000	\$	27,000	
	Interior exposed concrete	LS	job	\$	25,000	\$	25,000	
	Piping	LS	job	\$	22,000	S	22,000	
	Miscel. Metal	LS	job	\$	7,000	\$	7,000	
	Subtotal					\$	7,005,800	
							A STATE OF THE PARTY OF THE PAR	
	CHANICAL (Installed	costs U	ON)					
1	Pumps	100	•		4 00E 000	•	2 075 000	
	Axial Flow, 1000 cfs, 120"	ea	3		1,325,000	\$	3,975,000	
	Structural Support and Grating	ea	3	\$	60,000	\$	180,000	
2	Reduction Gear	ea	3	\$	200,000	\$	600,000	
	Lube Oil Cooling System	ea	3	\$	15,000	\$	45,000	
3	Diesel Engine	ea	3	\$	550,000	\$	1,650,000	
	Drive Shafts and Couplings	ea	3	\$	25,000	\$	75,000	
	Flex coupling	ea	3	\$	20,000	\$	60,000	
4	Exhaust System							
	Silencer and supports	ea	3	\$	30,000	\$	90,000	
	Piping & insulation	ea	3	\$	35,000	\$	105,000	
	Supports	ea	3	\$	10,000	\$	30,000	

			4				
	10' x 23' sst Roller Gate	ea	3	\$	155,000	\$	465,000
	Electric Operator	ea	3	\$	65,000	\$	195,000
	Dewatering Bulkheads 23' x 12'	ea	3	\$	120,000	\$	360,000
6	Cooling Water System	ea	3	\$	6,500	\$	19,500
	Pump - vert. turbine 30 Hp	ea	1	\$	20,000	\$	20,000
	Piping, valves and fittings	LS	job	\$	60,000	\$	60,000
100	Strainers and Filters	ea	3	\$	10,000	\$	30,000
7	Service Water System		W				
	Pump - vert. turbine 30 Hp	ea	1	\$	20,000	\$	20,000
	Piping, valves and fittings	LS	job	\$	15,000	\$	15,000
	Filtration System	LS	job	\$	10,000	\$	10,000
8	Potable Water System						
	Water Softener	ea	1	\$	15,000	\$	15,000
	Piping, valves, fittings	LS	job	\$	20,000	\$	20,000
	Reverse Osmosis	ea	1	\$	45,000	\$	45,000
	Pneumatic Tank	ea	-1	\$	6,500	\$	6,500
	Ultraviolent Unit	ea	1	\$	4,000	\$	4,000
9	Pump Lube Water System						
	Piping, valves and fittings	LS	job	\$	15,000	\$	15,000
	Backwash filters	LS	job	\$	25,000	\$	25,000
10	Compressed Air System						
	Compressor 30 Hp	ea	1	\$	8,000	\$	8,000
	Piping, fittings, valves	LS	job	\$	45,000	\$	45,000
	Air receivers	ea	3	\$	4,000	\$	12,000
	Filters	LS	job	\$	2,000	\$	2,000
11	Vacuum System						
	Pumps	ea	2	\$	25,000	\$	50,000
	Piping, valves, gages	LS	job	\$	120,000	\$	120,000
12	Fuel System						
	Engineering	LS	job	\$	35,000	\$	35,000
	Permits	LS	job	\$	10,000	\$	10,000
	Day Tanks	ea	3	\$	15,000	\$	45,000
	Storage Tanks - 20,000 gal.	ea	3	\$	100,000	\$	300,000
	Fuel Monitors and Instr.	LS	job	\$	60,000	\$	60,000
	Waste Fuel Tank 1000 gal.	ea	1	\$	7,500	\$	7,500
	Fuel Piping, Fittings, Filters	LS	job	\$	150,000	\$	150,000
	Transfer Pumps	ea	2	\$	7,500	\$	15,000
13	Lube Oil System						
	Storage Tank - 1,000 gal.	ea	1	\$	7,500	\$	7,500
	Transfer Pumps	ea	2	\$	3,500	\$	7,000
	Piping, fittings, valves	LS	job	\$	45,000	\$	45,000
14	Waste Lube Oil System						0.0000
	Waste Fuel Tank 300 gal.	ea	1	\$	4,000	\$	4,000
	Transfer Pump	ea	1	\$	3,500	\$	3,500
	Piping, fittings, valves	LS	iob	\$	20,000	\$	20,000
15	Sanitary Waste System		v <b>*</b> 0.700 1 11		(500,000,000)		
	Collection piping	LS	job	\$	5,000	\$	5,000
	Lift station	LS	job	\$	7,500	\$	7,500
	Septic Tank 1000 gal.	LS	job	\$	2,500	\$	2,500
	Drain Field	LS	job	\$	2,500	\$	2,500
16	Trash Rake		,		_,000	•	2,000
	Supports	LS	job	\$	80,000	\$	80,000
	porture # More (1976)	1950	,	0.7	30,000		55,500

Monoral		Monorail	If	200	\$	250	•	70.000
Trolley								
Gripper			10000		<b>D</b>	1000		
Bridge Crane   Bridge Crane and Trolley   LS   job   \$ 150,000								
Bridge Crane and Trolley	17		ea	2	\$	25,000	\$	50,000
Discharge Piping   Elbow, flanged 90 degree   ea   3   \$ 45,000 \$ 135,000 \$ 75,000 \$ Subtotal   \$ \$ 9,789,000 \$   \$ 75,000 \$ Subtotal   \$ \$ \$ 9,789,000 \$   \$ 9,789,000 \$   \$ 9,789,000 \$   \$ \$ 9,789,000 \$   \$ 9,789,000 \$	17				-			
Elbow, flanged 90 degree   ea   3   \$ 45,000   \$ 135,000   Null thimbles, rect. section   ea   3   \$ 25,000   \$ 75,000   \$ 9,789,000	40		LS	Job	\$	150,000	\$	150,000
Wall thimbles, rect. section   Subtotal   \$3	10	3- F-3		_		11272.5		
Name								135,000
HVAC (Installed costs UON)  1			ea	3	\$	25,000		75,000
Control Room A/C		Subtotal					\$	9,789,000
Break Room A/C	H۱	(	N)					
Break Room A/C	1	Control Room A/C	LS	job	\$	30.000	S	30.000
Duct work/grilles/etc.		Break Room A/C	LS	job				
Ventilation Fans		Duct work/grilles/etc.	LS					
Intake Roll Filters	2	Ventilation Fans				,	•	20,000
Intake Roll Filters		Equipment, installed	ea	6	\$	5 500	\$	33,000
Hoods			ea					
Miscel Vents and Fans   LS   job   \$ 10,000   \$ 10,000		Hoods						
4 Controls Subtotal LS job \$ 7,500 \$ 7,500 \$ 158,000 \$ 158,000 \$ 158,000 \$ 158,000 \$ 150,000 \$ 1	3	Miscel. Vents and Fans		7			10000	
Subtotal   S   158,000	4	Controls	7.7.7.7.1	•				
Power Distribution		Subtotal		,	•	,,000		
Power Distribution	=1	ECTRICAL (installed seets LIQ	AD.					
Panelboards		[18] [18] [18] [18] [18] [18] [18] [18]	N)					
Entrance, disconnects, etc. LS job \$ 50,000 \$ 50,000  Building distribution Slab rough-in LS job \$ 120,000 \$ 120,000 Feeder rough-in LS job \$ 150,000 \$ 150,000 Branch Circuits LS job \$ 200,000 \$ 200,000 Grounding LS job \$ 35,000 \$ 35,000  2 Emergency Power Generator, 300kw ea 2 \$ 120,000 \$ 240,000 Transfer switch/controls ea 2 \$ 45,000 \$ 90,000 Wiring, boxes LS job \$ 80,000 \$ 80,000  3 Lighting Exterior LS job \$ 15,000 \$ 15,000 Interior LS job \$ 25,000 \$ 25,000 Emergency LS job \$ 25,000 \$ 25,000  4 Lightning Protection System LS job \$ 25,000 \$ 25,000 Security System LS job \$ 15,000 \$ 15,000 Subtotal  CONTROL AND COMMUNICATIONS 1 Engine Control Center PLC, software, etc. ea 3 \$ 50,000 \$ 150,000 Conversion Modules ea 3 \$ 10,000 \$ 30,000 I/O instrumentation ea 3 \$ 20,000 \$ 60,000 Programming LS job \$ 15,000 \$ 10,000 Auxiliary interface systems ea 3 \$ 15,000 \$ 10,000 Auxiliary interface systems ea 3 \$ 15,000 \$ 45,000	1					1000000	- 3	
Building distribution   Slab rough-in				•			4	
Feeder rough-in		Building distribution	07270	Job	\$	50,000	\$	50,000
Branch Circuits				job	\$	120,000	\$	120,000
Grounding			LS	job	\$	150,000	\$	150,000
2 Emergency Power Generator, 300kw ea 2 \$ 120,000 \$ 240,000 Transfer switch/controls ea 2 \$ 45,000 \$ 90,000 Wiring, boxes LS job \$ 80,000 \$ 80,000  3 Lighting Exterior LS job \$ 15,000 \$ 15,000 Interior LS job \$ 25,000 \$ 25,000 Emergency LS job \$ 7,500 \$ 7,500 4 Lightning Protection System LS job \$ 25,000 \$ 25,000 5 Security System LS job \$ 25,000 \$ 25,000 Subtotal S job \$ 15,000 \$ 15,000 CONTROL AND COMMUNICATIONS 1 Engine Control Center PLC, software, etc. ea 3 \$ 50,000 \$ 150,000 Conversion Modules ea 3 \$ 10,000 \$ 30,000 I/O instrumentation ea 3 \$ 20,000 \$ 60,000 Programming LS job \$ 10,000 \$ 10,000 Auxiliary interface systems ea 3 \$ 15,000 \$ 45,000		Branch Circuits	LS	job	\$	200,000	\$	200,000
Emergency Power   Generator, 300kw   ea   2   \$   120,000   \$   240,000   Transfer switch/controls   ea   2   \$   45,000   \$   90,000   Wiring, boxes   LS   job   \$   80,000   \$   80,000   \$   30,00		Grounding	LS	job	\$	35,000	\$	35,000
Transfer switch/controls ea 2 \$ 45,000 \$ 90,000 Wiring, boxes LS job \$ 80,000 \$ 80,000 \$ 3 Lighting Exterior LS job \$ 15,000 \$ 15,000 Interior LS job \$ 25,000 \$ 25,000 \$ 25,000 \$ Emergency LS job \$ 7,500 \$ 7,500 \$ 7,500 \$ 7,500 \$ 15,000 \$ 15,000 \$ 15,000 \$ 15,000 \$ 15,000 \$ 15,000 \$ 15,000 \$ 15,000 \$ 15,000 \$ 15,000 \$ 15,000 \$ 15,000 \$ 15,000 \$ 10,000 \$ 10,000 \$ 10,000 \$ 10,000 \$ 10,000 \$ 10,000 \$ 10,000 \$ 10,000 \$ 10,000 \$ 15,000 \$ 10,000 \$ 10,000 \$ 10,000 \$ 10,000 \$ 10,000 \$ 15,000 \$ 10,000 \$ 10,000 \$ 10,000 \$ 10,000 \$ 10,000 \$ 10,000 \$ 10,000 \$ 10,000 \$ 10,000 \$ 10,000 \$ 15,000 \$ 15,000 \$ 15,000 \$ 15,000 \$ 10,000	2	Emergency Power						
Transfer switch/controls ea 2 \$ 45,000 \$ 90,000 Wiring, boxes LS job \$ 80,000 \$ 80,000 \$ 30,000 \$ 15,0		Generator, 300kw	ea	2	\$	120,000	\$	240,000
Wiring, boxes		Transfer switch/controls	ea	2	\$	45,000	\$	
Lighting   Exterior		Wiring, boxes	LS	job	\$	80,000	S	
Interior	3	Lighting		A-7.1				
Interior		Exterior	LS	job	\$	15,000	\$	15.000
Emergency LS job \$ 7,500 \$ 7,500 4 Lightning Protection System LS job \$ 25,000 \$ 25,000 5 Security System LS job \$ 15,000 \$ 15,000 Subtotal \$ 15,000 \$ 1,202,500  CONTROL AND COMMUNICATIONS 1 Engine Control Center PLC, software, etc. ea 3 \$ 50,000 \$ 150,000 Conversion Modules ea 3 \$ 10,000 \$ 30,000 I/O instrumentation ea 3 \$ 20,000 \$ 60,000 Programming LS job \$ 10,000 \$ 10,000 Auxiliary interface systems ea 3 \$ 15,000 \$ 45,000		Interior	LS	job				
4 Lightning Protection System LS job \$ 25,000 \$ 25,000 \$ 25,000 \$ Security System LS job \$ 15,000 \$ 15,000 \$ 15,000 \$ 1,202,500 \$ 15,000 \$ 1,202,500 \$ 15,000 \$ 1,202,500 \$ 1,		Emergency	LS	iob				
Security System	4	Lightning Protection System	LS	job				
Subtotal	5		LS			85.12		
1 Engine Control Center PLC, software, etc. ea 3 \$ 50,000 \$ 150,000 Conversion Modules ea 3 \$ 10,000 \$ 30,000 I/O instrumentation ea 3 \$ 20,000 \$ 60,000 Programming LS job \$ 10,000 \$ 10,000 Auxiliary interface systems ea 3 \$ 15,000 \$ 45,000		Subtotal				,		
1 Engine Control Center PLC, software, etc. ea 3 \$ 50,000 \$ 150,000 Conversion Modules ea 3 \$ 10,000 \$ 30,000 I/O instrumentation ea 3 \$ 20,000 \$ 60,000 Programming LS job \$ 10,000 \$ 10,000 Auxiliary interface systems ea 3 \$ 15,000 \$ 45,000	CO	NTROL AND COMMUNICATION	IS					
Conversion Modules         ea         3         \$ 10,000         \$ 30,000           I/O instrumentation         ea         3         \$ 20,000         \$ 60,000           Programming         LS         job         \$ 10,000         \$ 10,000           Auxiliary interface systems         ea         3         \$ 15,000         \$ 45,000								
Conversion Modules         ea         3         \$ 10,000         \$ 30,000           I/O instrumentation         ea         3         \$ 20,000         \$ 60,000           Programming         LS         job         \$ 10,000         \$ 10,000           Auxiliary interface systems         ea         3         \$ 15,000         \$ 45,000			ea	3	S	50,000	\$	150 000
I/O instrumentation     ea     3     \$ 20,000     \$ 60,000       Programming     LS     job     \$ 10,000     \$ 10,000       Auxiliary interface systems     ea     3     \$ 15,000     \$ 45,000								
Programming LS job \$ 10,000 \$ 10,000 Auxiliary interface systems ea 3 \$ 15,000 \$ 45,000		I/O instrumentation	ea		\$			
Auxiliary interface systems ea 3 \$ 15,000 \$ 45,000		Programming	LS	job	\$			
Cobinet udden select at a			ea		\$			
		Cabinet, wiring, relays, etc.	ea	3		the second second second	\$	

# South Florida Water Management District **EAA Reservoir A-1 Basis of Design Report**

2	Drimany Canada						
2	Primary Console						
	SCADA Nodes	ea	3	\$	10,000	\$	30,000
	Workstation Module	ea	1 -	\$	25,000		25,000
	Notebook Computers	ea	1	\$	7,000		7,000
	Main PLC Control Panel	ea	1	\$	75,000	\$	75,000
	Remote I/O Panels	LS	job	\$	45,000		45,000
	Itellution Software	LS	job	\$	28,000	\$	28,000
200	Programing	LS	job	\$	30,000	\$	30,000
3	Instrumentation						
	Ultrasonic level transmitters	ea	10	\$	4,500	\$	45,000
	Level switches	ea	10	\$	3,500	\$	35,000
	Flow switches	ea	9	\$	1,500	\$	13,500
	Pressure transmitters	ea	3	\$	5,000	\$	15,000
	Pressure switches	ea	6	\$	1,200	\$	7,200
4	UPS and Surge Protection	LS	job	\$	20,000	\$	20,000
5	Antenna and transmitter	ea	1	\$	30,000	\$	30,000
6	Engineering Services	LS	job	\$	30,000	\$	30,000
	TOTAL					\$	925,700
017	T WORK						000000500000
1	E WORK						
4	Intake Basin						
	Clearing	LS	job	\$	5,000	\$	5,000
	Stone Protection	су	3900	\$	80	\$	312,000
	Excavation	су	33000	\$	5	\$	165,000
2	Discharge Channel						
	Excavation	су	20800	\$	5	\$	104,000
_	Stone Protection	су	3600	\$	80	\$	288,000
3	Wingwalls and Cutoff Walls						
	Sheet pile, installed	tn	300	\$	2,000	\$	600,000
	Cap, Reinforced Concrete	lf	240	\$	120	\$	28,800
	Tie-back	ea	4	\$	55,000	\$	220,000
	Backfill, granular	су	5000	\$	7	\$	35,000
	Handrail	lf	240	\$	35	\$	8,400
4	Station Site						1.
	Asphalt w/ Limerock Base	sy	2000	\$	15	\$	30,000
	Safety Barrier	LS	job	\$	20,000	\$	20,000
	Weed Barrier	LS	job	\$	15,000	\$	15,000
	Security Fence	If	800	\$	10	\$	8,000
	Security Gates	ea	4	\$	350	\$	1,400
	Site fill from local borrow	су	20000	\$	5	\$	100,000
5	Staff Gages	ea	2	\$	750	\$	1,500
6	Platforms w/ stilling wells	ea	2	\$	90,000	\$	180,000
7	Access Roads and Ramps				33556705000		
	Embankment Fill (borrow)	су	7500	\$	5	\$	37,500
	Limerock Base	sy	5500	S	9	\$	49,500
	Guradrail	If	500	\$	22	S	11,000
	Grading, Miscellaneous	LS	iob	\$	25,000	\$	25,000
8	Grassing/Sodding	LS	job	\$	10,000	\$	10,000
	Subtotal		1.00	7	,	\$	2,255,100
	SUBTOTAL					\$	24,424,900
	20% Contingency					\$	4,884,980
	TOTAL					\$	
						Ψ	29,309,880

Item Description	E	AA RESERVOIR A-1 PUMP	STATION	AL				
DVERHEAD   Bonds	(3)	1000 cfs Horizontal Pumps						7/2/2005
Bonds	Ite	m Description	Unit	Quantity	Un	it Cost		Total
Builders Risk	01	/ERHEAD						
Builders Risk		Bonds	LS	iob	\$	130.000	S	130,000
Licenses		Builders Risk	LS	•				
Insurance		Licenses	LS	job				
Owner's Offices         mn         24         \$ 4,000         \$ 96,000           Contractor's Offices         mn         24         \$ 4,000         \$ 96,000           Utilities         mn         24         \$ 3,000         \$ 72,000           Quality Control Testing         LS         job         \$ 80,000         \$ 80,000           Engineering Consultant         LS         job         \$ 50,000         \$ 50,000           Scheduling Consultant         mn         24         \$ 3,500         \$ 84,000           Administration Staff         mn         24         \$ 40,000         \$ 960,000           Field Engineering and Survey         LS         job         \$ 60,000         \$ 60,000           Subtotal         Tofferdam 200 ft. x 100 ft., install and remove         el. +14 to -36, 50 ft./PZ35 sht.         ton         525         \$ 1,600         \$ 840,000           Bracing and tie-back system         LS         job         \$ 350,000         \$ 350,000         \$ 360,000           Pumping         mn         9         \$ 12,000         \$ 108,000           Detention Basin         LS         job         \$ 24,000         \$ 24,000           Excavation         cy         3400         \$ 5         \$ 170,000 </td <td></td> <td>Insurance</td> <td>LS</td> <td>job</td> <td></td> <td></td> <td></td> <td></td>		Insurance	LS	job				
Utilities		Owner's Offices	mn	24	\$	4,000	\$	
Utilities		Contractor's Offices	mn	24	\$	4,000	S	
Engineering Consultant		Utilities	mn	24	\$	3,000	\$	
Engineering Consultant		Quality Control Testing	LS	job	\$	80,000	\$	
Administration Staff			LS	job	\$	50,000	\$	50,000
Administration Staff		Scheduling Consultant	mn	24	\$	3,500	\$	
DEWATERING   1   Cofferdam 200 ft. x 100 ft., install and remove el. +14 to -36, 50 ft./PZ35 sht. ton   525   \$ 1,600 \$ 840,000 Pumping mn   9 \$ 12,000 \$ 108,000 Pumping mn   9 \$ 12,000 \$ 108,000 Subtotal   STRUCTURE (Installed costs UON)   1   Reinforced Concrete w/ embeds Base Slab   Cy   2674   \$ 400 \$ 1,699,600 Pump Embeds   LS   job   \$ 3000 \$ 1,693,200 Pump Embeds   LS   job   \$ 7,000 \$ 1,693,200 Pump Embeds   LS   job   \$ 7,000 \$ 1,693,200 Pump Embeds   LS   job   \$ 7,000 \$ 1,000 Piers   Cy   1422   \$ 400 \$ 568,800 Piers   Cy   1424   \$ 500 \$ 500 \$ 50,000 Piers   Cy   140 \$ 500 \$ 70,000 Piers   Cy   140 \$		Administration Staff	mn	24		40,000	\$	
DEWATERING   1   Cofferdam 200 ft. x 100 ft., install and remove   el. +14 to -36, 50 ft./PZ35 sht. ton   525   \$ 1,600 \$ 840,000   Bracing and tie-back system   LS   job   \$ 350,000 \$ 350,000   Pumping   mn   9   \$ 12,000 \$ 108,000   Detention Basin   LS   job   \$ 24,000 \$ 24,000   Subtotal		Field Engineering and Survey	LS	job	\$	60,000	\$	60,000
1 Cofferdam 200 ft. x 100 ft., install and remove el. +14 to -36, 50 ft./PZ35 sht. ton 525 \$ 1,600 \$ 840,000 Bracing and tie-back system LS job \$ 350,000 \$ 350,000 Pumping mn 9 \$ 12,000 \$ 108,000 Detention Basin LS job \$ 24,000 \$ 24,000 2 Excavation cy 34000 \$ 5 \$ 170,000 Subtotal \$ 1,492,000  STRUCTURE (Installed costs UON) 1 Reinforced Concrete w/ embeds Base Slab cy 2674 \$ 400 \$ 1,069,600 Abutments cy 2079 \$ 400 \$ 831,600 FSI to Operating Floor cy 2822 \$ 600 \$ 1,693,200 Pump Embeds LS job \$ 7,000 \$ 7,000 Piers cy 1422 \$ 400 \$ 568,800 Service Bridge cy 102 \$ 500 \$ 51,000 Fi'r Slab Embeds/Cover Plates LS job \$ 5,000 \$ 5,000 Operating floor slab w/ beam cy 210 \$ 500 \$ 105,000 Discharge Tunnel to Oper. Fi'r. cy 750 \$ 600 \$ 450,000 Intake Noses cy 20 \$ 600 \$ 12,000 Service water intake cy 140 \$ 500 \$ 70,000 Interior Fuel Trench w/ grating LS job \$ 7,000 \$ 7,000 Tank Slab cy 40 \$ 400 \$ 16,000 Exterrior Fuel Trench w/ cover LS job \$ 12,000 Sexter Fuel Trench w/ cover LS job \$ 12,000 Sexter Fuel Trench w/ cover LS job \$ 12,000 Sulkhead Slot Embeds LS job \$ 15,000 \$ 10,000 Pump Supports cy 37 \$ 500 \$ 15,000 Pump Support Ring LS job \$ 15,000 \$ 13,000 Pump Support Ring LS job \$ 15,000 \$ 15,000 Pump Support Ring LS job \$ 15,000 \$ 15,000		Subtotal		5		- 5	\$	1,808,000
el. +14 to -36, 50 ft./PZ35 sht.	DE	WATERING					60	
Bracing and tie-back system LS job \$ 350,000 \$ 350,000 Pumping mn 9 \$ 12,000 \$ 108,000 Detention Basin LS job \$ 24,000 \$	1	Cofferdam 200 ft. x 100 ft., insta	I and remove	ve				
Bracing and tie-back system   LS   job   \$ 350,000   \$ 350,000   Pumping   mn   9   \$ 12,000   \$ 108,000   Detention Basin   LS   job   \$ 24,000   \$ 24,		el. +14 to -36, 50 ft./PZ35 sht.	ton	525	\$	1,600	\$	840,000
Detention Basin		Bracing and tie-back system	LS	job	\$	350,000	\$	350,000
Detention Basin		Pumping	mn	9	\$	12,000	\$	108,000
STRUCTURE   (Installed costs UON)   1   Reinforced Concrete w/ embeds   Base Slab   Cy   2674   \$   400   \$   1,069,600   Abutments   Cy   2079   \$   400   \$   831,600   FSI to Operating Floor   Cy   2822   \$   600   \$   1,693,200   Pump Embeds   LS   job   \$   7,000   \$   7,000   Piers   Cy   1422   \$   400   \$   568,800   Service Bridge   Cy   102   \$   500   \$   51,000   FI'r Slab Embeds/Cover Plates   LS   job   \$   5,000   \$   5,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   450,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   450,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   450,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   450,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   450,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   450,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   450,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   450,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   450,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   12,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   12,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   12,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   12,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   12,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   12,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   12,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   12,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   12,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   12,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   12,000   Charage Tunnel to Oper. Fi'r   Cy   750   \$   600   \$   12,000   Charage Tunnel to Oper. Fi'r   Cy   750   Charage Tunnel t		Detention Basin	LS	job	\$	24,000		
STRUCTURE (Installed costs UON)   1   Reinforced Concrete w/ embeds   Base Slab   Cy   2674   \$ 400   \$ 1,069,600   Abutments   Cy   2079   \$ 400   \$ 831,600   FSI to Operating Floor   Cy   2822   \$ 600   \$ 1,693,200   Pump Embeds   LS   job   \$ 7,000   \$ 7,000   Piers   Cy   1422   \$ 400   \$ 568,800   Service Bridge   Cy   102   \$ 500   \$ 51,000   FI'r Slab Embeds/Cover Plates   LS   job   \$ 5,000   \$ 5,000   Cyerating floor slab w/ beam   Cy   210   \$ 500   \$ 105,000   Cyerating floor slab w/ beam   Cy   210   \$ 500   \$ 450,000   Cyerating floor slab w/ beam   Cy   210   \$ 500   \$ 450,000   Cyerating floor slab w/ beam   Cy   210   \$ 500   \$ 105,000   Cyerating floor slab w/ beam   Cy   210   \$ 500   \$ 105,000   Cyerating floor slab w/ beam   Cy   210   \$ 500   \$ 105,000   Cyerating floor slab w/ beam   Cy   210   \$ 500   \$ 105,000   Cyerating floor slab w/ beam   Cy   210   \$ 500   \$ 105,000   Cyerating floor slab w/ beam   Cy   210   \$ 500   \$ 105,000   Cyerating floor slab w/ beam   Cy   210   \$ 500   \$ 105,000   Cyerating floor slab w/ beam   Cy   210   \$ 500   \$ 105,000   Cyerating floor slab w/ beam   Cy   210   \$ 500   \$ 105,000   Cyerating floor slab w/ beam   Cy   210   \$ 500   \$ 105,000   Cyerating floor slab w/ beam   Cy   210   \$ 500   \$ 105,000   Cyerating floor slab w/ beam   Cy   210   \$ 500   \$ 105,000   Cyerating floor slab w/ beam   Cy   210   \$ 500   \$ 105,000   Cyerating floor slab w/ beam   Cy   210   \$ 500   \$ 105,000   Cyerating floor slab w/ beam   Cy   210   \$ 500   \$ 105,000   Cyerating floor slab w/ beam   Cy   210   \$ 500   \$ 105,000   Cyerating floor slab w/ beam   Cyerating floor sl	2		су	34000	\$	5	\$	
Reinforced Concrete w/ embeds   Base Slab		Subtotal						
Reinforced Concrete w/ embeds   Base Slab	ST	RUCTURE (Installed costs LION)						
Base Slab         cy         2674         \$ 400         \$ 1,069,600           Abutments         cy         2079         \$ 400         \$ 831,600           FSI to Operating Floor         cy         2822         \$ 600         \$ 1,693,200           Pump Embeds         LS         job         \$ 7,000         \$ 7,000           Piers         cy         1422         \$ 400         \$ 568,800           Service Bridge         cy         102         \$ 500         \$ 51,000           Fl'r Slab Embeds/Cover Plates         LS         job         \$ 5,000         \$ 5,000           Operating floor slab w/ beam         cy         210         \$ 500         \$ 5,000           Operating floor slab w/ beam         cy         210         \$ 500         \$ 105,000           Discharge Tunnel to Oper. Fl'r.         cy         750         \$ 600         \$ 450,000           Intake Noses         cy         20         \$ 600         \$ 12,000           Service water intake         cy         140         \$ 500         \$ 7,000           Interior Fuel Trench w/ grating         LS         job         \$ 7,000         \$ 7,000           Tank Slab         cy         40         \$ 12,000         \$ 12,000								
Abutments cy 2079 \$ 400 \$ 831,600 FSI to Operating Floor cy 2822 \$ 600 \$ 1,693,200 Pump Embeds LS job \$ 7,000 \$ 7,000 Piers cy 1422 \$ 400 \$ 568,800 Service Bridge cy 102 \$ 500 \$ 51,000 Pi'r Slab Embeds/Cover Plates LS job \$ 5,000 \$ 5,000 Discharge Tunnel to Oper. Fi'r. cy 750 \$ 600 \$ 450,000 Intake Noses cy 20 \$ 600 \$ 12,000 Service water intake cy 140 \$ 500 \$ 70,000 Interior Fuel Trench w/ grating LS job \$ 7,000 \$ 7,000 Tank Slab cy 40 \$ 400 \$ 16,000 Exterior Fuel Trench w/ cover LS job \$ 12,000 \$ 12,000 Service water intake LS job \$ 12,000 \$ 12,000 Sexterior Fuel Trench w/ cover LS job \$ 12,000 Sexterior Fuel Trench w/ cover LS job \$ 12				2674		400	•	1 000 000
FSI to Operating Floor cy 2822 \$ 600 \$ 1,693,200 Pump Embeds LS job \$ 7,000 \$ 7,000 Piers cy 1422 \$ 400 \$ 568,800 Service Bridge cy 102 \$ 500 \$ 51,000 Piers LS job \$ 5,000 \$ 5,000 Operating floor slab w/ beam cy 210 \$ 500 \$ 105,000 Discharge Tunnel to Oper. Fi'r. cy 750 \$ 600 \$ 12,000 Operating floor slab w/ beam cy 20 \$ 600 \$ 12,000 Operating floor slab w/ beam cy 20 \$ 600 \$ 12,000 Operating floor slab w/ beam cy 20 \$ 600 \$ 12,000 Operating floor slab w/ beam cy 20 \$ 600 \$ 12,000 Operating floor slab w/ beam cy 20 \$ 600 \$ 12,000 Operating floor slab w/ beam cy 20 \$ 600 \$ 12,000 Operating floor slab w/ beam cy 20 \$ 600 \$ 12,000 Operating floor slab w/ show show show show show show show show			70.73	0.00001011010		200		
Pump Embeds         LS         job         \$ 7,000         \$ 7,000           Piers         cy         1422         \$ 400         \$ 568,800           Service Bridge         cy         102         \$ 500         \$ 51,000           Fl'r Slab Embeds/Cover Plates         LS         job         \$ 5,000         \$ 5,000           Operating floor slab w/ beam         cy         210         \$ 500         \$ 105,000           Discharge Tunnel to Oper. Fl'r.         cy         750         \$ 600         \$ 450,000           Intake Noses         cy         20         \$ 600         \$ 12,000           Service water intake         cy         140         \$ 500         \$ 7,000           Interior Fuel Trench w/ grating         LS         job         \$ 7,000         \$ 7,000           Tank Slab         cy         40         \$ 400         \$ 16,000           Exterior Fuel Trench w/ cover         LS         job         \$ 12,000         \$ 12,000           Bulkhead Slot Embeds         LS         job         \$ 15,000         \$ 15,000           Pump Supports         cy         37         \$ 500         \$ 18,500           Pump Support Ring         LS         job         \$ 15,000         \$ 15,000<								
Piers         cy         1422         \$ 400         \$ 568,800           Service Bridge         cy         102         \$ 500         \$ 51,000           Fİ'r Slab Embeds/Cover Plates         LS         job         \$ 5,000         \$ 5,000           Operating floor slab w/ beam         cy         210         \$ 500         \$ 105,000           Discharge Tunnel to Oper. Fİ'r.         cy         750         \$ 600         \$ 450,000           Intake Noses         cy         20         \$ 600         \$ 12,000           Service water intake         cy         140         \$ 500         \$ 70,000           Interior Fuel Trench w/ grating         LS         job         \$ 7,000         \$ 7,000           Tank Slab         cy         40         \$ 400         \$ 16,000           Exterior Fuel Trench w/ cover         LS         job         \$ 12,000         \$ 12,000           Bulkhead Slot Embeds         LS         job         \$ 15,000         \$ 30,000           Pump Supports         cy         37         \$ 500         \$ 18,500           Pump Support Ring         LS         job         \$ 15,000         \$ 15,000								
Service Bridge         cy         102         \$ 500         \$ 51,000           Fl'r Slab Embeds/Cover Plates         LS         job         \$ 5,000         \$ 5,000           Operating floor slab w/ beam         cy         210         \$ 500         \$ 105,000           Discharge Tunnel to Oper. Fl'r.         cy         750         \$ 600         \$ 450,000           Intake Noses         cy         20         \$ 600         \$ 12,000           Service water intake         cy         140         \$ 500         \$ 70,000           Interior Fuel Trench w/ grating         LS         job         \$ 7,000         \$ 7,000           Tank Slab         cy         40         \$ 400         \$ 16,000           Exterior Fuel Trench w/ cover         LS         job         \$ 12,000         \$ 12,000           Bulkhead Slot Embeds         LS         job         \$ 15,000         \$ 30,000           Gates Slot/Sill Embeds         LS         job         \$ 30,000         \$ 30,000           Pump Supports         cy         37         \$ 500         \$ 15,000				•			25.0	
Fi'r Slab Embeds/Cover Plates LS job \$ 5,000 \$ 5,000 Operating floor slab w/ beam cy 210 \$ 500 \$ 105,000 Discharge Tunnel to Oper. Fi'r. cy 750 \$ 600 \$ 450,000 Intake Noses cy 20 \$ 600 \$ 12,000 Service water intake cy 140 \$ 500 \$ 70,000 Interior Fuel Trench w/ grating LS job \$ 7,000 \$ 7,000 Tank Slab cy 40 \$ 400 \$ 16,000 Exterior Fuel Trench w/ cover LS job \$ 12,000 \$ 12,000 Bulkhead Slot Embeds LS job \$ 15,000 \$ 15,000 Gates Slot/Sill Embeds LS job \$ 30,000 \$ 30,000 Pump Supports cy 37 \$ 500 \$ 18,500 Pump Support Ring LS job \$ 15,000 \$ 15,000			11.00			0.000		
Operating floor slab w/ beam         cy         210         \$ 500         \$ 105,000           Discharge Tunnel to Oper. Fl'r.         cy         750         \$ 600         \$ 450,000           Intake Noses         cy         20         \$ 600         \$ 12,000           Service water intake         cy         140         \$ 500         \$ 70,000           Interior Fuel Trench w/ grating         LS         job         \$ 7,000         \$ 7,000           Tank Slab         cy         40         \$ 400         \$ 16,000           Exterior Fuel Trench w/ cover         LS         job         \$ 12,000         \$ 12,000           Bulkhead Slot Embeds         LS         job         \$ 15,000         \$ 30,000           Gates Slot/Sill Embeds         LS         job         \$ 30,000         \$ 30,000           Pump Supports         cy         37         \$ 500         \$ 18,500           Pump Support Ring         LS         job         \$ 15,000         \$ 15,000		FI'r Slab Embeds/Cover Plates			\$			
Discharge Tunnel to Oper. Fi'r.         cy         750         \$ 600         \$ 450,000           Intake Noses         cy         20         \$ 600         \$ 12,000           Service water intake         cy         140         \$ 500         \$ 70,000           Interior Fuel Trench w/ grating         LS         job         \$ 7,000         \$ 7,000           Tank Slab         cy         40         \$ 400         \$ 16,000           Exterior Fuel Trench w/ cover         LS         job         \$ 12,000         \$ 12,000           Bulkhead Slot Embeds         LS         job         \$ 15,000         \$ 15,000           Gates Slot/Sill Embeds         LS         job         \$ 30,000         \$ 30,000           Pump Supports         cy         37         \$ 500         \$ 18,500           Pump Support Ring         LS         job         \$ 15,000         \$ 15,000		Operating floor slab w/ beam			s			
Intake Noses					s			
Service water intake         cy         140         \$ 500         \$ 70,000           Interior Fuel Trench w/ grating         LS         job         \$ 7,000         \$ 7,000           Tank Slab         cy         40         \$ 400         \$ 16,000           Exterior Fuel Trench w/ cover         LS         job         \$ 12,000         \$ 12,000           Bulkhead Slot Embeds         LS         job         \$ 15,000         \$ 15,000           Gates Slot/Sill Embeds         LS         job         \$ 30,000         \$ 30,000           Pump Supports         cy         37         \$ 500         \$ 18,500           Pump Support Ring         LS         job         \$ 15,000         \$ 15,000				100000000000000000000000000000000000000	S	7.7.3		0.000
Interior Fuel Trench w/ grating LS job \$ 7,000 \$ 7,000 Tank Slab cy 40 \$ 400 \$ 16,000 Exterior Fuel Trench w/ cover LS job \$ 12,000 \$ 12,000 Bulkhead Slot Embeds LS job \$ 15,000 \$ 15,000 Gates Slot/Sill Embeds LS job \$ 30,000 \$ 30,000 Pump Supports cy 37 \$ 500 \$ 18,500 Pump Support Ring LS job \$ 15,000 \$ 15,000		Service water intake		140	\$		-	
Tank Slab         cy         40         \$ 400         \$ 16,000           Exterior Fuel Trench w/ cover         LS         job         \$ 12,000         \$ 12,000           Bulkhead Slot Embeds         LS         job         \$ 15,000         \$ 15,000           Gates Slot/Sill Embeds         LS         job         \$ 30,000         \$ 30,000           Pump Supports         cy         37         \$ 500         \$ 18,500           Pump Support Ring         LS         job         \$ 15,000         \$ 15,000		Interior Fuel Trench w/ grating						
Exterior Fuel Trench w/ cover LS job \$ 12,000 \$ 12,000 Bulkhead Slot Embeds LS job \$ 15,000 \$ 15,000 Gates Slot/Sill Embeds LS job \$ 30,000 \$ 30,000 Pump Supports cy 37 \$ 500 \$ 18,500 Pump Support Ring LS job \$ 15,000 \$ 15,000								
Bulkhead Slot Embeds         LS         job         \$ 15,000         \$ 15,000           Gates Slot/Sill Embeds         LS         job         \$ 30,000         \$ 30,000           Pump Supports         cy         37         \$ 500         \$ 18,500           Pump Support Ring         LS         job         \$ 15,000         \$ 15,000		Exterior Fuel Trench w/ cover						
Gates Slot/Sill Embeds         LS         job         \$ 30,000         \$ 30,000           Pump Supports         cy         37         \$ 500         \$ 18,500           Pump Support Ring         LS         job         \$ 15,000         \$ 15,000		Bulkhead Slot Embeds						
Pump Supports         cy         37         \$ 500         \$ 18,500           Pump Support Ring         LS         job         \$ 15,000         \$ 15,000		Gates Slot/Sill Embeds						
Pump Support Ring LS job \$ 15,000 \$ 15,000								
Mind A 10,000								
					\$	3,500	S	7.000

	Dies Calles Hatches					_	
	Pipe Gallery Hatches	LS	job	\$	3,000		3,000
	Equipment Slabs	су	25	\$	500	\$	12,500
2	Total		10323				
2	Pump House 50 ft. x 140 ft. w/ 40			100	-200	2 0300	
	Precast Panel w/ embeds	sf	15200	\$	23	\$	349,600
	Steel Frame	LS	job	\$	135,000	\$	135,000
	Bridge Crane haunches/girders		job	\$	30,000	\$	30,000
	Double Tee Precast Roof	sf	7000	\$	25	\$	175,000
	Roof Covering	sq	70	\$	500		35,000
	Add. Floor slab w/ col. pads	су	100	\$	400	\$	40,000
	Miscel. Sealants, etc	LS	job	\$	15,000	\$	15,000
	Control Rm. Slab/Walls/Beams		105	\$	300	\$	31,500
	Control Rm. Stairs	LS	job	\$	3,500	\$	3,500
	Wheel chair lift	ea	1	\$	20,000	\$	20,000
	Control Rm. Viewing Windows	LS	job	\$	5,000	\$	5,000
	Restroom Fixtures	LS	job	\$	4,500	\$	4,500
	Ladder w/ roof hatch	ea	1	\$	10,000	\$	10,000
	Break Room Fixtures	LS	job	\$	5,000	\$	5,000
	Counters, cabinets	LS	job	\$	8,500	\$	8,500
	Overhead doors w/ storm bars	ea	2	\$	13,000	\$	26,000
	Doors and hardware	ea	6	\$	3,500	\$	21,000
	Interior drywall, flooring etc.	LS	job	\$	8,000	\$	7,500
_	Specialties, i.e. lockers	LS	job	\$	15,000	\$	15,000
3	Miscellaneous	eres.					
	Grating, embeds, steel support	sf	700	\$	45	\$	31,500
	Miscel. Embeds	LS	job	\$	10,000	\$	10,000
	Handrail	If	210	\$	35	\$	7,350
4	Trash Rack						
	Rack, 42 x 23 sst	ea	3	\$	65,000	\$	195,000
	Supports and Embeds	ea	3	\$	25,000	\$	75,000
-	Rack 10 x 12 service water	ea	1	\$	20,000	\$	20,000
5	Coatings	- 2-2	50.5				
	Exterior exposed concrete	LS	job	\$	35,000	\$	35,000
	Interior exposed concrete	LS	job	\$	20,000	\$	20,000
	Piping	LS	job	\$	35,000	\$	35,000
	Miscel. Metal	LS	job	\$	7,000	\$	7,000
	Subtotal					\$	6,372,150
ME	CHANICAL (Installed of	costs UON)					
1	Pumps	osis uon)					
	Axial Flow, 1000 cfs. 124"	ea	3		405.000	•	4.075.000
	Structural Support and Grating	ea	3		,425,000	\$	4,275,000
2	Reduction Gear		3	\$	20,000	\$	60,000
4	Lube Oil Cooling System	ea	3	\$	220,000	\$	660,000
3	Diesel Engine	ea	3	\$	15,000	\$	45,000
J	Drive Shafts and Couplings	ea	3	\$	550,000	\$	1,650,000
	Flex coupling	ea	3	\$	35,000	\$	105,000
4	Exhaust System	ea	3	\$	20,000	\$	60,000
4	Silencer and supports	00	2	•	20.000	•	00.000
	Piping & insulation	ea ea	3	\$	30,000	\$	90,000
	Supports	ea	3	\$	35,000	\$	105,000
5		ea	3	\$	10,000	\$	30,000
•	Sound Mater Cystem	ca	J	Þ	6,500	\$	19,500

	Pump - vert. turbine 30 Hp	ea	1	\$	20,000	\$	20,000
	Piping, valves and fittings	LS	job	\$	60,000		60,000
	Strainers and Filters	ea	3	\$	10,000		30,000
6	Service Water System				,		00,000
	Pump - vert. turbine 30 Hp	ea	1	\$	20,000	\$	20,000
	Piping, valves and fittings	LS	iob	\$	15,000	\$	15,000
	Filtration System	LS	job	\$	10,000	\$	10,000
7	Potable Water System		,		10,000	•	10,000
	Water Softener	ea	1	\$	15,000	\$	15,000
	Piping, valves, fittings	LS	job	\$	20,000	\$	20,000
	Reverse Osmosis	ea	1	\$	45,000	S	45,000
	Pneumatic Tank	ea	1	\$	6,500	S	6,500
	Ultraviolent Unit	ea	i	s	4,000	S	
8	Pump Lube Water System			•	4,000	Ψ	4,000
	Piping, valves and fittings	LS	iob	\$	15,000	\$	15 000
	Backwash filters	LS	iob	\$	25,000	\$	15,000
7	Compressed Air System	LO	JOD	φ	25,000	Ф	25,000
	Compressor 30 Hp	ea	1	\$	9 000	•	0.000
	Piping, fittings, valves	LS	job	\$	8,000	\$	8,000
	Air receivers	ea	3	\$	45,000		45,000
	Filters	LS	job	\$	4,000	\$	12,000
8	Vacuum System	LO	Job	4	2,000	\$	2,000
•	Pumps	ea	2	•	25.000	•	70.000
	Piping, valves, gages	LS	iob	\$	35,000	\$	70,000
9	Fuel System	LO	JOD	Ф	130,000	\$	130,000
3	Engineering	10	i.e.b.	•	05.000		
	Permits	LS	job	\$	35,000	\$	35,000
	Day Tanks	LS	job	\$	10,000	\$	10,000
		ea	3	\$	15,000	\$	45,000
	Storage Tanks - 20,000 gal.	ea	3	\$	100,000	\$	300,000
	Fuel Monitors and Instr.	LS	job	\$	60,000	\$	60,000
	Waste Fuel Tank 1000 gal.	ea	1	\$	7,500	\$	7,500
	Fuel Piping, Fittings, Filters	LS	job	\$	150,000	\$	150,000
40	Transfer Pumps	ea	2	\$	7,500	\$	15,000
10	Lube Oil System						
	Storage Tanks - 1,000 gal.	ea	1	\$	7,500	\$	7,500
	Transfer Pumps	ea	2	\$	3,500	\$	7,000
	Piping, fittings, valves	LS	job	\$	45,000	\$	45,000
11	Waste Lube Oil System						
	Waste Fuel Tank 300 gal.	ea	1	\$	4,000	\$	4,000
	Transfer Pump	ea	1	\$	3,500	\$	3,500
	Piping, fittings, valves	LS	job	\$	20,000	\$	20,000
12	Sanitary Waste System						
	Collection piping	LS	job	\$	5,000	\$	5,000
	Lift station	LS	job	\$	7,500	\$	7,500
	Septic Tank 1000 gal.	LS	job	\$	2,500	\$	2,500
	Drain Field	LS	job	\$	2,500	\$	2,500
13	Trash Rake		970			1357	
	Supports	LS	job	\$	100,000	\$	100,000
			-				

# South Florida Water Management District **EAA Reservoir A-1 Basis of Design Report**

July, 2005

	Managait	16	050				
	Monorail	lf	250	\$	350	\$	87,500
	Containment Area	ea	2	\$	20,000	\$	40,000
	Trolley	ea	2	\$		\$	90,000
	Gripper	ea	2	\$	25,000	\$	50,000
14	Dewatering Gates		10-00				
	14.5' x 23' sst Roller Gate	ea	3	\$	175,000	\$	525,000
	Electric Operator	ea	3	\$	65,000	\$	195,000
	Dewatering Bulkheads 23'x12'	ea	3	\$	120,000	\$	360,000
15	Bridge Crane		- 200	100			
	Bridge Crane and Trolley	LS	job	\$	110,000	\$	110,000
16	Discharge Piping	102	192	9			
	Pipe, steel, flanged	If	40	\$	550	\$	22,000
	Elbow, flanged 90 degree	ea	3	\$	50,000	\$	150,000
	Elbow, flanged - 45 degree	ea	3	\$	25,000	\$	75,000
	Thrust Supports	LS	job	\$	5,000	\$	5,000
	Wall thimbles	ea	3	\$	25,000	\$	75,000
	Subtotal					\$	10,263,500
HV	AC (Installed costs UON	1)					
1	Control Room A/C	LS	iob	\$	30,000	\$	30,000
	Break Room A/C	LS	iob	\$	20,000	\$	20,000
	Duct work/grilles/etc.	LS	job	\$	20,000	\$	20,000
2	Ventilation Fans		,	7	_0,000	•	20,000
100	Equipment, installed	ea	6	\$	5,500	\$	33,000
	Intake Roll Filters	ea	3	\$	5,500	\$	16,500
	Hoods	ea	6	\$	3,500	S	21,000
3	Miscel. Vents and Fans	LS	iob	\$	10,000	\$	10,000
4	Controls	LS	job	S	7,500	\$	7,500
	Subtotal		,00	•	1,000	\$	158,000
E1 1	ECTRICAL (installed costs UON	v					
1	Power Distribution	,					
	Panelboards	LS	iob	\$	150,000	•	450,000
	Entrance, disconnects, etc.	LS	job	\$	***	\$	150,000
	Building distribution	LO	Job	Ф	50,000	Þ	50,000
	Slab rough-in	LS	iob	•	100 000	•	400.000
	Feeder rough-in	LS		\$	120,000	\$	120,000
	Branch Circuits	LS	job		150,000	\$	150,000
			job	\$	200,000	\$	200,000
2	Grounding	LS	job	\$	35,000	\$	35,000
2	Emergency Power			•	100 000		
	Generator, 300kw	ea	2	\$	120,000	\$	240,000
	Transfer switch/controls	ea	2	\$	45,000	\$	90,000
•	Wiring, boxes	LS	job	\$	80,000	\$	80,000
3	Lighting						
	Exterior	LS	job	\$	15,000	\$	15,000
	Interior	LS	job	\$	20,000	\$	20,000
	Emergency	LS	job	\$	7,500	\$	7,500
4	Lightning Protection System	LS	job	\$	25,000	\$	25,000
5	Security System Subtotal	LS	job	\$	15,000	\$	15,000
	Subtotal					\$	1,197,500

CONTROL AND COMMUNICATIONS

### A Reservoir A-1 Basis of Design Report July, 2005

	1	Engine Control Center						
		PLC, software, etc.	ea	3	\$	50,000	\$	150,000
pro-		Conversion Modules	ea	3	\$	10,000	\$	30,000
		I/O instrumentation	ea	3	\$	20,000	\$	60,000
		Programming	LS	job	\$	10,000	\$	10,000
		Auxiliary interface systems	ea	3	\$	15,000	Š	45,000
		Cabinet, wiring, relays, etc.	ea	3	Š	65,000	\$	195,000
	2	시다. 하는데 이 가게 하는데 하는데 이 생각이 되는데 하지만 하는데 이 사람이 없다.	Ca	3	4	05,000	Ψ	133,000
1-	2	Primary Console	ea	3	\$	10,000	s	30,000
		SCADA Nodes		1	\$		\$	
		Workstation Module	ea	1		25,000		25,000
		Notebook Computers	ea		\$	7,000	\$	7,000
		Main PLC Control Panel	ea	1	\$	75,000	\$	75,000
F		Remote I/O Panels	LS	job	\$	45,000	\$	45,000
		Itellution Software	LS	job	\$	28,000	\$	28,000
-	-0	Programing	LS	job	\$	30,000	\$	30,000
	3	Instrumentation						
		Ultrasonic level transmitters	ea	10	\$	4,500	\$	45,000
		Level switches	ea	10	\$	3,500	\$	35,000
		Flow switches	ea	9	\$	1,500	\$	13,500
P3		Pressure transmitters	ea	3	\$	5,000	\$	15,000
18		Pressure switches	ea	6	\$	1,200	\$	7,200
_	4	UPS and Surge Protection	LS	job	\$	20,000	\$	20,000
	5	Antenna and transmitter	ea	1	\$	30,000	\$	30,000
	6	Engineering Services	LS	job	\$	30,000	\$	30,000
		TOTAL		•			\$	925,700
-								
-	2.5	E WORK						
	1	Intake Basin			929	1123 5325	920	927222
_		Clearing	LS	job	\$	5,000	\$	5,000
		Stone Protection	су	3900	\$	80	\$	312,000
E		Excavation	cy	33000	\$	5	\$	165,000
E .	2	Discharge Channel						
		Excavation	су	20800	\$	5	\$	104,000
·		Stone Protection	су	3600	\$	80	\$	288,000
100	3	Wingwalls and Cutoff Walls	- 5					
-		Sheet pile, installed	tn	300	\$	2,000	\$	600,000
		Cap, Reinforced Concrete	If	240	\$	120	\$	28,800
		Tie-back	ea	4	\$	55,000	\$	220,000
		Backfill, granular	су	5000	\$	7	\$	35,000
		Handrail	If	240	\$	35	\$	8,400
	4	Station Site					•	-,
	-	Asphalt w/ Limerock Base	sy	2000	\$	15	\$	30,000
		Safety Barrier	LS	job	\$	20,000	Š	20,000
		Weed Barrier	LS	job	\$	15,000	Š	15,000
7		Security Fence	lf .	800	\$	10,000	\$	8,000
		[ 전기 (1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		4	\$	350	\$	1,400
-		Security Gates	ea					
	-	Site fill from local borrow	су	20000	\$	5 750	\$	100,000
	5	Staff Gages	ea	2		750	\$	1,500
	6	Stilling Wells - Platform	ea	2	\$	90,000	\$	180,000
, bear	7	Access Roads and Ramps				523		
		Embankment Fill (borrow)	су	7500	\$	5	\$	37,500
		Limerock Base	sy	5500	\$	9	\$	49,500
		Guradrail	If	500	\$	22	\$	11,000
		Grading, Miscellaneous	LS	job	\$	25,000	\$	25,000
	8	Grassing/Sodding	LS	job	\$	10,000	\$	10,000
	2.7	Subtotal SUBTOTAL				\$		2,255,100 24,516,950
						\$		4,903,390
		20% Contingency				\$		29,420,340
	,	UIAL				÷		23,720,070

# South Florida Water Management District **EAA Reservoir A-1 Basis of Design Report**

EAA	RESERVOIR PUMP STAT	TION	ALTER	NAT	IVE No.	3A	
(4) 750	cfs Vertical Pumps w/ FSI						7/2/2005
Item D	escription	Unit	Quantity	Un	it Cost		Total
OVER	HEAD		*				
В	onds	LS	job	\$	130,000	\$	130,000
В	uilders Risk	LS	job	\$	70,000	\$	70,000
Li	censes	LS	job	\$	10,000	\$	10,000
In	surance	LS	iob	\$	100,000	\$	100,000
0	wner's Offices	mn	24	\$	4,000	\$	96,000
C	ontractor's Offices	mn	24	\$	4,000	\$	96,000
U	tilities	mn	24	\$	3,000	\$	72,000
Q	uality Control Testing	LS	job	\$	80,000	\$	80,000
E	ngineering Consultant	LS	job	\$	50,000	\$	50,000
	cheduling Consultant	mn	24	\$	3,500	\$	84,000
	dministration Staff	mn	24	\$	40,000	\$	960,000
Fi	eld Engineering and Survey	LS	job	\$	60,000	\$	60,000
S	ubtotal					\$	1,808,000
DEWA	TERING						
1 C	offerdam 205 ft. x 105 ft., install	and remov	/e				
0.00	el. +14 to -36, 50 ft./PZ35 sht.	ton	455	\$	1,600	\$	728,000
	Bracing and tie-back system	LS	iob	\$	325,000	\$	325,000
	Pumping	mn	9	\$	11,000	\$	99,000
	Detention Basin	LS	iob	\$	20,000	\$	20,000
10000	xcavation	су	25000	S	20,000	\$	125,000
	ubtotal	C,	20000	Ψ	3	\$	1,297,000
							## # CO # CO CO CO CO
	TURE (Installed costs UON)						
	einforced Concrete w/ Embeds						
	ntake Base Slab	су	2603	\$	400	\$	1,041,200
	ntake Abutments	су	1985	\$	400	\$	794,000
F	SI to Operating Floor	су	2010	\$	600	\$	1,206,000
	Pump Embeds	LS	job	\$	14,000	\$	14,000
	ntake Piers	су	2304	\$	400	\$	921,600
	Service Bridge	су	130	\$	500	\$	65,000
	Approach Slabs	су	60	\$	400	\$	24,000
	Fi'r slab emb'ds/covers/support		4	\$	20,000	\$	80,000
	ntake Noses	су	20	\$	600	\$	12,000
	Tank Slab	су	40	\$	400	\$	16,000
	Exterior Fuel Trench w/ cover	LS	job	\$	15,000	\$	15,000
	Service water intake	су	140	\$	500	\$	70,000
	nterior fuel trench w/ grating	LS	job	\$	7,000	\$	7,000
	Bulkhead Slot Embeds	LS	job	\$	25,000	\$	25,000
	Sates Slot/Sill Embeds	ea	2	\$	30,000	\$	60,000
	Sate operating plaform	су	60	\$	500	\$	30,000
	liscel. Embeds, grating	LS	job	\$	4,500	\$	4,500
	ump Support Ring	LS	job	\$	15,000	\$	15,000
A	liscel. Access ladders	ea	2	\$	3,500	\$	7,000

	Pipe Gallery Hatches	LS	job	\$	3,000	\$ 3,000
	Equipment Slabs	су	30	\$	500	\$ 15,000
	Total		9390			
2	Pump House 80 ft. x 93 ft. w/ 50 ft					
	Precast Panel w/ embeds	sf	17300	\$	23	\$ 397,900
	Steel Frame	LS	job	\$	140,000	\$ 140,000
	Bridge Crane haunches/girders		job	\$	30,000	\$ 30,000
	Double Tee Precast Roof	sf	7440	\$	25	\$ 186,000
	Roof Covering	sq	75	\$	500	\$ 37,500
	Miscel. Sealants, etc	LS	job	\$	15,000	\$ 15,000
	Control Rm. Slab/Walls/Beams	су	135	\$	550	\$ 74,250
	Control Rm. Stairs	LS	job	\$	3,500	\$ 3,500
	Wheel chair lift	ea	1	\$	20,000	\$ 20,000
	Control Rm. Viewing Windows	LS	job	\$	10,000	\$ 10,000
	Restroom Fixtures	LS	job	\$	4,500	\$ 4,500
	Break Room Fixtures	LS	job	\$	5,000	\$ 5,000
	Counters, cabinets	LS	job	\$	8,500	\$ 8,500
	Overhead doors w/ storm bars	ea	2	\$	13,000	\$ 26,000
	Doors and hardware	ea	6	\$	3,500	\$ 21,000
	Interior drywall, flooring etc.	LS	job	\$	10,000	\$ 7,500
	Specialties, i.e. lockers	LS	job	\$	15,000	\$ 15,000
	Access manway	ea	4	\$	4,500	\$ 18,000
	Ladder w/ roof hatch	ea	1	\$	10,000	\$ 10,000
4	Miscellaneous					
	Grating, embeds, steel support	sf	450	\$	45	\$ 20,250
	Access ladders/platforms	LS	job	\$	3,500	\$ 3,500
	Handrail	lf	200	\$	35	\$ 7,000
5	Trash Rack					
	Rack, 38 x 19.5 sst	ea	4	\$	60,000	\$ 240,000
	Supports and Embeds	ea	4	\$	22,000	\$ 88,000
	Rack 10 x 12 service water	. ea	1	\$	20,000	\$ 20,000
6	Coatings					
	Exterior exposed concrete	LS	job	\$	29,000	\$ 29,000
	Interior exposed concrete	LS	job	\$	27,000	\$ 27,000
	Piping	LS	job	\$	24,000	\$ 24,000
	Miscel. Metal	LS	job	\$	7,000	\$ 7,000
	Subtotal					\$ 5,920,700
			100000			
-	CHANICAL (Installed	costs U	ON)			
1	Pumps		1927	2.00		
	Axial Flow, 750 cfs, 102"	ea	4	\$	900,000	\$ 3,600,000
2	Reduction Gear	ea	4	\$	110,000	\$ 440,000
	Lube Oil Cooling System	ea	4	\$	13,000	\$ 52,000
3	Diesel Engine	ea	4	\$	450,000	\$ 1,800,000
	Drive Shafts and Couplings	ea	4	\$	21,000	\$ 84,000
	Flex coupling	ea	4	\$	13,000	\$ 52,000
4	Exhaust System					
	Silencer and supports	ea	4	\$	24,000	\$ 96,000
	Piping & insulation	ea	4	\$	30,000	\$ 120,000
	Supports	ea	4	\$	6,000	\$ 24,000
5	Dewatering Gates					
	16' x 19.5' sst Roller Gate	ea	4	\$	165,000	\$ 660,000

	Electric Operator	-00			05.000	•	000.000
6	Cooling Water System	ea	4	\$	65,000	\$	260,000
•	Pump - vert. turbine 30 Hp	ea	1	\$	6,500	\$	26,000
	Piping, valves and fittings	LS	job	\$	20,000	\$	20,000
	Strainers and Filters	ea	4	\$		\$	60,000
7	Service Water System	ca	4	Þ	8,000	\$	32,000
	Pump - vert. turbine 30 Hp	ea	1	\$	20,000	\$	20,000
	Piping, valves and fittings	LS	job	\$	15,000	5	15,000
	Filtration System	LS	job	\$	10,000	\$	10,000
8	Potable Water System				,	•	10,000
	Water Softener	ea	1	\$	15,000	\$	15,000
	Piping, valves, fittings	LS	job	\$	20,000	\$	20,000
	Reverse Osmosis	ea	1	\$	45,000	\$	45,000
	Pneumatic Tank	ea	1	\$	6,500	\$	6,500
	Ultraviolent Unit	ea	1	\$	4,000	\$	4,000
9	Pump Lube Water System						0.53/0.00
	Piping, valves and fittings	LS	job	\$	20,000	\$	20,000
	Backwash filters	LS	job	\$	25,000	\$	25,000
10	Compressed Air System						
	Compressor 30 Hp	ea	1	\$	8,000	\$	8,000
	Piping, fittings, valves	LS	job	\$	55,000	\$	55,000
	Air receivers	ea	4	\$	3,500	\$	14,000
	Filters	LS	job	\$	2,000	\$	2,000
11	Vacuum System		V-20-				
	Pumps	ea	2	\$	2,300	\$	4,600
40	Piping, valves, gages	LS	job	\$	130,000	\$	130,000
12	Fuel System						10000000
	Engineering	LS	job	\$	35,000	\$	35,000
	Permits Day Tanks	LS	job	\$	10,000	\$	10,000
	Day Tanks	ea	4	\$	12,000	\$	48,000
	Storage Tanks - 20,000 gal. Fuel Monitors and Instr.	ea LS	iob	\$	100,000	\$	300,000
	Waste Fuel Tank 1000 gal.	ea	1	\$	60,000	\$	60,000
	Fuel Piping, Fittings, Filters	LS	job	\$	7,500	\$	7,500
	Transfer Pumps	ea	2	\$	160,000 7,500	\$	160,000
13	Lube Oil System	Cu	_	4	7,500	Ψ	15,000
20.00	Storage Tank - 1,000 gal.	ea	1	\$	7,500	\$	7,500
	Transfer Pumps	ea	2	\$	3,500	\$	7,000
	Piping, fittings, valves	LS	job	\$	45,000	\$	45,000
14	Waste Lube Oil System	11.77	,		10,000	•	40,000
	Waste Fuel Tank 300 gal.	ea .	1	\$	4,000	\$	4,000
	Transfer Pump	ea	1	\$	3.500	\$	3,500
	Piping, fittings, valves	LS	job	\$	20,000	\$	20,000
15	Sanitary Waste System				100		,,,,,,
	Collection piping	LS	job	\$	5,000	\$	5,000
	Lift station	LS	job	\$	7,500	\$	7,500
	Septic Tank 1000 gal.	LS	job	\$	2,500	\$	2,500
	Drain Field	LS	job	\$	2,500	\$	2,500
16	Trash Rake						19 (#10001 V/Z)
	Supports	LS	job	\$	80,000	\$	80,000
	Monorail	lf	200	\$	350	\$	70,000
	Containment Area	ea	2	\$	20,000	\$	40,000

## South Florida Water Management District **EAA Reservoir A-1 Basis of Design Report**

	Trolley	ea	2	\$	45,000	\$	90,000
	Gripper	ea	2	\$	25,000	\$	50,000
17	Bridge Crane				000000 <del>0</del> 00000000000000000000000000000		10.000
	Bridge Crane and Trolley	LS	job	\$	150,000	\$	150,000
18	<b>Backflow Prevention Gates</b>				No.	7.5	
	10' x 14' sst Roller Gate	ea	4	\$	125,000	\$	500,000
	Electric Operator	ea	4	\$	45,000	\$	180,000
	Dewatering Bulkhead 19.5'x12'	ea	3	\$	105,000	\$	315,000
19	Discharge Piping						
	102" steel pipe, flanged	If	300	\$	250	\$	75,000
	Flex. Coupling	ea	4	\$	8,500	\$	34,000
	45 degree elbow	ea	4	\$	20,000	\$	80,000
	Pump discharge elbow	ea	4	\$	45,000	\$	180,000
	Wall thimbles, rect. section	ea	4	\$	20,000	\$	80,000
	Subtotal					\$	10,384,100
HV	AC (Installed costs UON)						
1	Control Room A/C	LS	job	\$	30,000	\$	20,000
	Break Room A/C	LS	job	\$	20,000	\$	30,000 20,000
	Duct work/grilles/etc.	LS	iob	\$	20,000	\$	20,000
2	Ventilation Fans	LO	JOD	4	20,000	Φ	20,000
-	Equipment, installed	ea	6	\$	5,500	\$	33,000
	Intake Roll Filters	ea	3	\$	5,500	\$	16,500
	Hoods	ea	6	\$	3,500	\$	
3	Miscel, Vents and Fans	LS	iob	\$	10,000	\$	21,000 10.000
4	Controls	LS	job	\$	7,500	\$	7,500
-	Subtotal	LO	Jon	4	7,500	\$	158,000
	Cubicui					*	100,000
ELI	ECTRICAL (installed costs UON)						
1	Power Distribution						
	Panelboards	LS	job	\$	150,000	\$	150,000
	Entrance, disconnects, etc.  Building distribution	LS	job	\$	50,000	\$	50,000
	Slab rough-in	LS	job	\$	120,000	\$	120,000
	Feeder rough-in	LS	job	\$	150,000	\$	120,000
	Branch Circuits	LS	job	\$	200,000	\$	150,000
	Grounding	LS		\$		\$	200,000
2	Emergency Power	LO	job	Þ	35,000	Þ	35,000
-	Generator, 300kw	ea	2	\$	120 000	•	240.000
	Transfer switch/controls	ea	2	\$	120,000	\$	240,000
	Wiring, boxes	LS		\$	45,000		90,000
3	Lighting	LO	job	Ф	80,000	\$	80,000
3	Exterior	LS	inh	•	45.000	•	45.000
	Interior	LS	job	\$	15,000	\$	15,000
			job	\$	25,000	\$	25,000
4	Emergency	LS	job	\$	7,500	\$	7,500
5	Lightning Protection System	LS	job	\$	25,000	\$	25,000
5	Security System Subtotal	LS	job	\$	15,000	\$	15,000
	Subtotal					\$	1,202,500
	NTROL AND COMMUNICATIONS	3					
1	Engine Control Center						
	PLC, software, etc.	ea	4	\$	50,000	\$	200,000

	Conversion Modules	ea	4	\$	10,000	\$	40,000
	I/O instrumentation	ea	4	\$	20,000	\$	80,000
	Programming	LS	job	\$	10,000	\$	10,000
	Auxiliary interface systems	ea	4	\$	15,000	\$	60,000
	Cabinet, wiring, relays, etc.	ea	4	S	65,000	\$	260,000
2	Primary Console			- 1		-0100	
10.54	SCADA Nodes	ea	4	\$	10,000	\$	40,000
	Workstation Module	ea	1	\$	25,000	\$	25,000
	Notebook Computers	ea	1	\$	7,000	\$	7,000
	Main PLC Control Panel	ea	1	\$	75,000	\$	75,000
	Remote I/O Panels	LS	iob	\$	45,000	\$	45,000
	Itellution Software	LS	iob	Š	28,000	\$	28,000
	Programing	LS	job	S	30,000	\$	30,000
3	Instrumentation	LO	Job	•	00,000	Ψ	00,000
5	Ultrasonic level transmitters	ea	11	\$	4,500	\$	49,500
	Level switches	ea	11	\$	3,500	\$	38,500
	Flow switches	ea	10	\$	1,500	\$	15,000
	Pressure transmitters	ea	4	\$	5,000	\$	20,000
	Pressure switches	ea	7	\$	1,200	\$	8,400
4		LS	job	\$	20,000	\$	20,000
5	UPS and Surge Protection		1	\$		\$	
	Antenna and transmitter	ea		\$	30,000		30,000
6	Engineering Services	LS	job	Þ	30,000	\$	30,000
	TOTAL					\$	1,111,400
CIT	E WORK						
7.00							
1	Intake Basin	10	inh	•	F 000	•	E 000
	Clearing	LS	job	\$	5,000	\$	5,000
	Stone Protection	су	3900	\$	80	\$	312,000
_	Excavation	су	33000	\$	5	\$	165,000
2	Discharge Channel		00000	•	-	•	404.000
	Excavation	су	20800	\$	5	\$	104,000
	Stone Protection	су	3600	\$	80	\$	288,000
3	Wingwalls and Cutoff Walls	27	020	2			
	Sheet pile, installed	tn	300	\$	2,000	\$	600,000
	Cap, Reinforced Concrete	lf	240	\$	120	\$	28,800
	Tie-back	ea	4	\$	55,000	\$	220,000
	Backfill, granular	cy	5000	\$	7	\$	35,000
	Handrail	lf	240	\$	35	\$	8,400
4	Station Site		100000	0.9		4525	TO SERVICE STATE
	Asphalt w/ Limerock Base	sy	2000	\$	15	\$	30,000
	Safety Barrier	LS	job	\$	20,000	\$	20,000
	Weed Barrier	LS	job	\$	15,000	\$	15,000
	Security Fence	If	800	\$	10	\$	8,000
	Security Gates	ea	4	\$	350	\$	1,400
	Site fill from local borrow	cy	20000	\$	5	\$	100,000
5	Staff Gages	ea	2	\$	750	\$	1,500
6	Platforms w/ stilling wells	ea	2	\$	90,000	\$	180,000
7	Access Roads and Ramps						
	Embankment Fill (borrow)	су	7500	\$	5	\$	37,500
	Limerock Base	sy	5500	\$	9	\$	49,500
	Guradrail	If	500	\$	22	\$	11,000
	Grading, Miscellaneous	LS	iob	\$	25,000	\$	25,000
8	Grassing/Sodding	LS	job	s	10,000	\$	10,000
ĭ	Subtotal		,00	•	.0,000	\$	2,255,100
							_,,
	SUBTOTAL						24 400 200
	SUBTUIAL					\$	24,186,300
	200/ Cantings						4 007 000
	20% Contingency					\$	4,837,260
	TOTAL						00 000 000
	TOTAL					\$	29,023,560

EAA RESERVOIR PUMP STAT		ION	ALTERI	ALTERNATIVE No. 4A			
(5) 6	00 cfs Vertical Pumps w/ Rectar	ngular ir	ntake				7/2/2005
Item	Description	Unit	Quantity	Uni	Unit Cost		Total
OVE	RHEAD						
	Bonds	LS	job	\$	130,000	\$	130,000
	Builders Risk	LS	job	\$	70,000	\$	70,000
	Licenses	LS	job	\$	10,000	\$	10,000
	Insurance	LS	job	\$	100,000	\$	100,000
	Owner's Offices	mn	24	\$	4,000	\$	96,000
	Contractor's Offices	mn	24	\$	4,000	\$	96,000
	Utilities	mn	24	\$	3,000	\$	72,000
	Quality Control Testing	LS	job	\$	80,000	\$	80,000
	Engineering Consultant	LS	job	\$	50,000	\$	50,000
	Scheduling Consultant	mn	24	\$	3,500	\$	84,000
	Administration Staff	mn	24	\$	40,000	\$	960,000
	Field Engineering and Survey	LS	job	\$	60,000	\$	60,000
	Subtotal					\$	1,808,000
	VATERING						
1	Cofferdam 145 ft. x 150 ft., install				4		
	el. +14 to -36, 50 ft./PZ35 sht.	ton	516	\$	1,600	\$	825,600
	Bracing and tie-back system	LS	job	\$	345,000	\$	345,000
	Pumping	mn	9	\$	12,000	\$	108,000
	Detention Basin	LS	job	\$	20,000	\$	20,000
2	Excavation	cy	25000	\$	5	\$	125,000
	Subtotal					\$	1,423,600
STR	RUCTURE (Installed costs UON)						
1	Reinforced Concrete w/ Embeds		/2003/2007	100	0.000	n ani	
	Intake Base Slab	су	2800	\$	400	\$	1,120,000
	Intake Abutments	су	1621	\$	400	\$	648,400
	Breast wall/vert./horz.elements	су	1098	\$	500	\$	549,000
	Pump Embeds	LS	job	\$	15,000	\$	15,000
	Intake Piers	су	1958	\$	400	\$	783,200
	Service Bridge	су	300	\$	500	\$	150,000
	Approach Slabs	су	60	\$	400	\$	24,000
	FI'r slab emb'ds/covers/support	ea	5	\$	20,000	\$	100,000
	Intake Noses	су	26	\$	600	\$	15,600
	Tank Slab	су	40	\$	400	\$	16,000
	Exterior Fuel Trench w/ cover	LS	job	\$	15,000	\$	15,000
	Service water intake	су	140	\$	500	\$	70,000
	Interior fuel trench w/ grating	LS	job	\$	7,500	\$	7,500
	<b>Bulkhead Slot Embeds</b>	LS	job	\$	25,000	\$	25,000
	Gates Slot/Sill Embeds	ea	2	\$	30,000	\$	60,000
	Gate operating plaform	су	100	\$	500	\$	50,000
	Miscel. Embeds, grating	LS	job	\$	4,500	\$	4,500
	Pump Support Ring	ea	5	\$	6,000	\$	30,000
	Miscel. Access ladders	ea	2	\$	3,500	\$	7,000

	Pipe Gallery Hatches	LS	job	\$	3,000	\$		3,000
	Equipment Slabs	су	32	\$	500	\$		16,000
	Total		8189					
2	Pump House 80 ft. x 135 ft. w/ 50	ft. parape	t height					
	Precast Panel w/ embeds	sf	21500	\$	23	\$		494,500
	Steel Frame	LS	job	\$	170,000	\$		170,000
	Bridge Crane haunches/girders		job	\$	45,000	\$		45,000
	Double Tee Precast Roof	sf	10800	\$	25	\$		270,000
	Roof Covering	sq	108	\$	500	\$		54,000
	Miscel. Sealants, etc	LS	job	\$	17,000	\$		17,000
	Control Rm. Slab/Walls/Beams		135	\$	550	\$		74,250
	Control Rm. Stairs	LS	job	\$	3,500	\$		3,500
	Wheel chair lift	ea	1	\$	20,000	\$		20,000
	Control Rm. Viewing Windows	LS	job	\$	10,000	\$		10,000
	Restroom Fixtures	LS	job	\$	4,500	\$		4,500
	Break Room Fixtures	LS	job	\$	5,000	\$		5,000
	Counters, cabinets	LS	job	\$	8,500	\$		8,500
	Overhead doors w/ storm bars	ea	2	\$	13,000	\$		26,000
	Doors and hardware	ea	6	\$	3,500	\$		21,000
	Interior drywall, flooring etc.	LS	job	\$	10,000	\$		7,500
	Specialties, i.e. lockers	LS	job	\$	15,000	\$		15,000
	Ladder w/ roof hatch	ea	1	\$	10,000	\$		10,000
4	Miscellaneous							
	Grating, embeds, steel support	sf	450	\$	45	\$		20,250
	Access ladders/platforms	LS	job	\$	3,500	\$		3,500
	Handrail .	If	350	\$	35	\$		12,250
5	Trash Rack							
	Rack, 40 x 23.5 sst	ea	5	\$	65,000	\$		325,000
	Supports and Embeds	ea	5	\$	22,000	\$		110,000
	Rack 10 x 12 service water	ea	1	\$	20,000	\$		20,000
6	Coatings							
	Exterior exposed concrete	LS	job	\$	35,000	\$		35,000
	Interior exposed concrete	LS	job	\$	30,000	\$		30,000
	Piping	LS	job	\$	26,000	\$		26,000
	Miscel, Metal	LS	job	\$	8,000	\$		8,000
	Subtotal					\$		5,554,950
ME	CHANICAL (Installed	costs UON	1)					
1	Pumps							
	Axial Flow, 600 cfs, 90"	ea	5	\$	700,000	\$		3,500,000
2	Reduction Gear	ea	5	\$	80,000	\$		400,000
	Lube Oil Cooling System	ea	5	\$	10,000	\$		50,000
3	Diesel Engine	ea	5	S	350,000	\$		1,750,000
	Drive Shafts and Couplings	ea	5	\$	17,000	\$		85,000
	Flex coupling	ea	5	\$	12,000	\$		60,000
4	Exhaust System			(5.7)	3.92			n
	Silencer and supports	ea	5	\$	20,000	\$	6	100,000
	Piping & insulation	ea	5	s	23,000	\$		115,000
	Supports	ea	5	s	4,000	\$		20,000
5	Dewatering Gates			•	.,000	•		_3,003
J	16' x 23.5' sst Roller Gate	ea	5	\$	185,000	\$		925,000
	Electric Operator	ea	5	\$	70,000	\$		350,000
	Licetic Operator	ou	•	Ψ	, 0,000	Ψ		000,000

## South Florida Water Management District **EAA Reservoir A-1 Basis of Design Report**

	Deatering Bulkhead 24'x12'	ea	3	\$	122,000	\$	366,000
6	Cooling Water System	Ca	0	•	122,000	Φ	300,000
	Pump - vert. turbine 30 Hp	ea	1	\$	20,000	\$	20.000
	Piping, valves and fittings	LS	job	\$	70,000	\$	70,000
	Strainers and Filters	ea	5	s	8,000	\$	40,000
7	Service Water System	-	•	•	0,000	Ψ	40,000
	Pump - vert. turbine 30 Hp	ea	1	\$	20,000	\$	20,000
	Piping, valves and fittings	LS	job	\$	15,000	\$	15,000
	Filtration System	LS	job	\$	10,000	\$	10,000
8	Potable Water System	7.7	,02		10,000	Ψ.	10,000
	Water Softener	ea	1	\$	15,000	\$	15,000
	Piping, valves, fittings	LS	job	\$	20,000	Š	20,000
	Reverse Osmosis	ea	1	\$	45,000	\$	45,000
	Pneumatic Tank	ea	1	\$	6,500	\$	6,500
	Ultraviolent Unit	ea	1	\$	4,000	\$	4,000
9	Pump Lube Water System			4.10	.,	7	1,000
	Piping, valves and fittings	LS	doj	\$	25,000	\$	25,000
	Backwash filters	LS	job	\$	25,000	\$	25,000
10	Compressed Air System						*
	Compressor 5 Hp	ea	1	\$	1,500	\$	1,500
	Piping, fittings, valves	LS	job	\$	2,000	\$	2,000
11	Fuel System		-				
	Engineering	LS	job	\$	35,000	\$	35,000
	Permits	LS	job	\$	10,000	\$	10,000
	Day Tanks	ea	5	\$	9,000	\$	45,000
	Storage Tanks - 20,000 gal.	ea	3	\$	100,000	\$	300,000
	Fuel Monitors and Instr.	LS	job	\$	65,000	\$	65,000
	Waste Fuel Tank 1000 gal.	ea	1	\$	7,500	\$	7,500
	Fuel Piping, Fittings, Filters	LS	job	\$	160,000	\$	160,000
	Transfer Pumps	ea	2	\$	7,500	\$	15,000
12	Lube Oil System						
	Storage Tank - 1,000 gal.	ea	1	\$	7,500	\$	7,500
	Transfer Pumps	ea	2	\$	3,500	\$	7,000
	Piping, fittings, valves	LS	job	\$	45,000	\$	45,000
13	Waste Lube Oil System						
	Waste Fuel Tank 300 gal.	ea	1	\$	4,000	\$	4,000
	Transfer Pump	ea	1	\$	3,500	\$	3,500
	Piping, fittings, valves	LS	job	\$	20,000	\$	20,000
14	Sanitary Waste System						
	Collection piping	LS	job	\$	5,000	\$	5,000
	Lift station	LS	job	\$	7,500	\$	7,500
	Septic Tank 1000 gal.	LS	job	\$	2,500	\$	2,500
	Drain Field	LS	job	\$	2,500	\$	2,500
15	Trash Rake	11002					
	Supports	LS	job	\$	80,000	\$	80,000
	Monorail	If	250	\$	350	\$	87,500
	Containment Area	ea	2	\$	20,000	\$	40,000
	Trolley	ea	2	\$	45,000	\$	90,000
4-	Gripper	ea	2	\$	25,000	\$	50,000
17	Bridge Crane	1.5		17548			
10	Bridge Crane and Trolley	LS	job	\$	150,000	\$	150,000
18	Backflow Prevention Gates						

	10' x 14' sst Roller Gate	ea	5	\$	125,000	\$	625,000
	Electric Operator	ea	5	\$	45,000	\$	225,000
19							
	90" steel pipe, flanged	lf	100	\$	250	\$	25,000
	Flex. Coupling	ea	5	\$	8,500	\$	42,500
	Pump discharge elbow	ea	5	\$	45,000	\$	225,000
	Wall thimbles, rect. section	ea	5	\$	20,000	\$	100,000
	Subtotal					\$	10,522,000
Н١	/AC (Installed costs UO)	N)					
1	Control Room A/C	LS	job	\$	30,000	\$	30,000
	Break Room A/C	LS	job	\$	20,000	\$	20,000
	Duct work/grilles/etc.	LS	job	\$	20,000	\$	20,000
2	Ventilation Fans						
	Equipment, installed	ea	6	\$	5,500	\$	33,000
	Intake Roll Filters	ea	3	\$	5,500	\$	16,500
	Hoods	ea	6	\$	3,500	\$	21,000
3	Miscel. Vents and Fans	LS	job	\$	10,000	\$	10,000
4	Controls	LS	job	\$	7,500	\$	7,500
	Subtotal					\$	158,000
El	ECTRICAL (installed costs UO)	N)					
1	Power Distribution						
	Panelboards	LS	job	\$	150,000	\$	150,000
	Entrance, disconnects, etc.	LS	job	\$	50,000	\$	50,000
	Building distribution		•				
	Slab rough-in	LS	job	\$	120,000	\$	120,000
	Feeder rough-in	LS	job	\$	150,000	\$	150,000
	Branch Circuits	LS	job	\$	200,000	\$	200,000
	Grounding	LS	job	\$	35,000	\$	35,000
2	Emergency Power						
	Generator, 300kw	ea	2	\$	120,000	\$	240,000
	Transfer switch/controls	ea	2	\$	45,000	\$	90,000
	Wiring, boxes	LS	job	\$	80,000	\$	80,000
3	Lighting						
	Exterior	LS	job	\$	15,000	\$	15,000
	Interior	LS	job	\$	25,000	\$	25,000
	Emergency	LS	job	\$	7,500	\$	7,500
4	Lightning Protection System	LS	job	\$	25,000	\$	25,000
5	Security System	LS	job	\$	15,000	\$	15,000
	Subtotal					\$	1,202,500
C	ONTROL AND COMMUNICATION	NS					
1	Engine Control Center			4		0020	22222
	PLC, software, etc.	ea	5	\$	50,000	\$	250,000
	Conversion Modules	ea	5	\$	10,000	\$	50,000
	I/O instrumentation	ea	5	\$	20,000	\$	100,000
	Programming	LS	job	\$	10,000	\$	10,000
	Auxiliary interface systems	ea	5 5	\$	15,000	\$	75,000
2	Cabinet, wiring, relays, etc. Primary Console	ea	5	Þ	65,000	Þ	325,000
_	SCADA Nodes	ea	5	\$	10,000	\$	50,000
	Workstation Module	ea	1	\$	25,000	\$	25,000

	55						
	Notebook Computers	ea	1	\$	7,000	\$	7,000
	Main PLC Control Panel	ea	1	\$	75,000	\$	75,000
	Remote I/O Panels	LS	job	\$	45,000	\$	45,000
	Itellution Software	LS	job	\$	28,000	\$	28,000
	Programing	LS	job	\$	30,000	\$	30,000
3	Instrumentation						
	Ultrasonic level transmitters	ea	12	\$	4,500	\$	54,000
	Level switches	ea	12	\$	3,500	\$	42,000
	Flow switches	ea	11	\$	1,500	\$	16,500
	Pressure transmitters	ea	5	\$	5,000	\$	25,000
	Pressure switches	ea	8	\$ \$ \$	1,200	\$	9,600
4	<b>UPS and Surge Protection</b>	LS	job	\$	20,000	\$	20,000
5	Antenna and transmitter	ea	1	\$	30,000	\$	30,000
6	Engineering Services	LS	job	S	30,000	\$	30,000
	TOTAL					\$	1,297,100
SI	TE WORK						
1	Intake Basin						
	Clearing	LS	job	\$	5,000	\$	5,000
	Stone Protection	су	4985	\$	80	\$	398,800
	Excavation	cy	39700	\$	5	\$	198,500
2	Discharge Channel	-,		•		*	100,000
	Excavation	су	24800	\$	5	\$	124,000
	Stone Protection	cy	4200	\$	80	\$	336,000
3	Wingwalls and Cutoff Walls	-,		•	-	•	000,000
	Sheet pile, installed	tn	300	\$	2,000	\$	600,000
	Cap, Reinforced Concrete	lf	240	\$	120	\$	28,800
	Tie-back	ea	4	\$	55,000	\$	220,000
	Backfill, granular	су	5000	\$	7	\$	35,000
	Handrail	If	240	\$	35	\$	8,400
4	Station Site			- 3		7	0,100
	Asphalt w/ Limerock Base	sy	2000	\$	15	\$	30,000
	Safety Barrier	LS	iob	\$	20,000	\$	20,000
	Weed Barrier	LS	job	\$	15,000	\$	15,000
	Security Fence	If	800	\$	10	\$	8,000
	Security Gates	ea	4	\$	350	\$	1,400
	Site fill from local borrow	су	20000	\$	5	\$	100,000
5	Staff Gages	ea	2	\$	750	\$	1,500
6	Platforms w/ stilling wells	ea	2	\$	90,000	\$	180,000
7	Access Roads and Ramps				50,555	•	100,000
	Embankment Fill (borrow)	су	7500	\$	5	\$	37,500
	Limerock Base	sy	5500	\$	9	\$	49,500
	Guradrail	If	500	\$	22	\$	11,000
	Grading, Miscellaneous	LS	job	\$	25,000	\$	25,000
8	Grassing/Sodding	LS	job	Š	10,000	S	10,000
	Subtotal	0.570.751		•	.0,000	\$	2,443,400
	SUBTOTAL					\$	24,463,550
	20% Contingency					\$	4,892,710
	TOTAL					\$	29,356,260

July, 2005

LCC ANALYSIS

EAA RESERVOIR A-1 PUMP STATION			
LIFE CYCLE COST ANALYSIS			
n - number of years service			25
I - interest rate			6.00%
p - inflation rate			3.50%
Real Discount Rate			2.50%
ALTERNATIVE 1			
		***	200 000
Initial Investment Cost			9,309,880
Energy Cost/Year		\$	924,290
Operating Cost per Year		\$ \$	278,875 32,111
Routine Maintenace per Year		ą.	32,111
Sum of Yearly Costs		\$ 1	1,235,276
Discount Factor for 25 Years			18.47
Present Value of Yearly Costs		\$22	2,815,548
Decommisioning Cost		\$	-
Cp/Cn Factor			0.58
Present Value of Final Year Costs		\$	
Present LCC Value		\$5	2,125,428
Present LCC Operating Costs			5,150,821
Present LCC Energy		\$1	7,071,636
Present LCC Routine Maintenace		\$	593,090
ALTERNATIVE 2			
Initial Investment Cost		\$2	9,420,340
Energy Cost/Year		\$	872,173
Operating Cost per Year		\$	278,875
Routine Maintenace per Year		\$	32,111
Sum of Yearly Costs		\$	1,183,159
Discount Factor for 25 Years			18.47
Present Value of Yearly Costs		\$2	1,852,947
Decommisioning Cost		\$	100,000
Cp/Cn Factor		1724	0.58
Present Value of Final Year Costs		\$	58,000
Present LCC Value			1,331,287
Present LCC Energy		100	6,109,035
Present LCC Operating Costs			5,150,821
Present LCC Routine Maintenace		\$	593,090

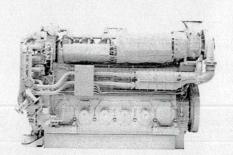
ALTERNATIVE 3A	
Initial Investment Cost	\$29,023,560
Energy Cost/Year	\$ 1,006,975
Operating Cost per Year	\$ 278,875
Routine Maintenace per Year	\$ 42,794
Sum of Yearly Costs	\$ 1,328,644
Discount Factor for 25 Years	18.47
Present Value of Yearly Costs	\$24,540,055
Decommisioning Cost	\$ 100,000
Cp/Cn Factor	0.58
Present Value of Final Year Costs	\$ 58,000
Present LCC Value	\$53,621,615
Present LCC Energy	\$18,598,828
Present LCC Operating Costs	\$ 5,150,821
Present LCC Routine Maintenace	\$ 790,405
ALTERNATIVE 4A	
Initial Investment Cost	\$29,356,260
Energy Cost/Year	\$ 998,446
Operating Cost per Year	\$ 278,875
Routine Maintenace per Year	\$ 53,492
Sum of Yearly Costs	\$ 1,330,813
Discount Factor for 25 Years	18.47
Present Value of Yearly Costs	\$24,580,116
Decommisioning Cost	\$ 100,000
Cp/Cn Factor	0.58
Present Value of Final Year Costs	\$ 58,000
Present LCC Value	\$53,994,376
Present LCC Energy	\$18,441,298
Present LCC Operating Costs	\$ 5,150,821
Present LCC Routine Maintenace	\$ 987,997

July, 2005

**EQUIPMENT/ENGINE DATA SHEETS** 

July, 2005





Shown with Accessory Equipment

### Marine Propulsion Engine

3606

1730-2030 bkW (2320-2722 bhp) @ 900-1000 rpm

#### **CATERPILLAR® ENGINE SPECIFICATIONS**

In-Line	6.	4-Strol	ce-Cvc	le-Diesel

EmissionsIMO compliant	
Bore — mm (in)	
Stroke — mm (in) 300 (11.8)	
Displacement — L (cu in)	
Rotation (from flywheel end) CCW or CW	
Compression Ratio13:1	
AspirationTurbocharged-Aftercooled	
ow Idle Speed — rpm350	
Rated Speed — rpm	
Average Piston Speed — m/s (ft/s) 9-10 (29.5-32.8)	
ingine Firing Pressure —	
har (noi) 100 170 (0 000 0 000)	

bar (psi)	. 162-173 (2,350-2,509)
BMEP — bar (psi)	22-22.9 (319-332)
BSFC — g/bkW-h (lb/hp-h)	197-206 (.324339)

#### PERFORMANCE DATA

Rated rpm	1000		900	
	bkW	bhp	bkW	bhp
Maximum Continuous	2030	2722	1900	2548
Continuous Service	1850	2481	1730	2320

#### STANDARD EQUIPMENT

#### Air Intake and Exhaust System

Charge air cooler, air inlet shutoff, high flow turbocharger, dry manifold with soft or hard shielding

#### **Basic Engine Arrangement**

In-line engine with one-piece grey iron cylinder block, individual cylinder heads with four intake/exhaust valves, right- or left-hand service side available

#### **Cooling System**

Single or combined system, engine mounted freshwater and seawater pumps, engine coolant water drains

#### Fuel System

Engine operates on MDO; fuel injection system is comprised of engine-driven fuel transfer pump and a unit injector for each cylinder, engine mounted duplex fuel filters, and flexible connections

#### **Lube Oil System**

Top-mounted crankcase breather, two centrifugal oil filters with single shutoff, gear-driven pump, duplex oil filter, crankcase explosion relief, oil filler and dipstick

#### Monitoring, Alarm, and Safety Control System

Alarms and shutdowns provided as required by marine society for unmanned machinery spaces. Marine Monitoring System II or Engine Control Panel are available; systems include temperature, pressure, and speed sensors; cylinder pressure relief valves, oil mist detector, and particle detector available

#### **Speed Control**

Electric actuator, programmable electronic governor, optional mechanical ballhead backup

#### General

Four lifting eyes mounted to cylinder heads, Caterpillar yellow paint, parts books and maintenance manuals, shrink wrap

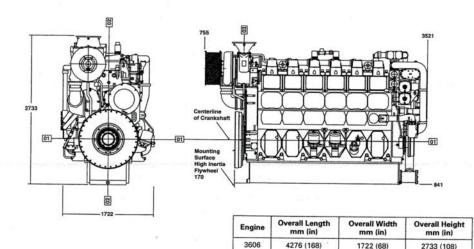
#### **Optional Supplied Equipment**

Torsional coupling, fresh water heat exchanger, fuel cooler, emergency pumps and connections, jacket water heater, flexible connections, and antivibration isolators

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### CATERPILLAR 3606 MARINE PROPULSION ENGINE — 1730-2030 bkW (2320-2722 bhp)



Engine Weights	kg (lb)	
Engine Dry Weight	15 680 (34,496)	
Shipped Loose Items: Torsional Coupling Plate-Type Heat Exchanger Instrument/Alarm Panel	319 (702) 400 (880) 200 (440)	
Fluids: Lube Oil Jacket Water Heat Exchanger (FW, SW, LO)	634 (1,395) 400 (880) 70 (154)	

#### RATING DEFINITIONS AND CONDITIONS

MAXIMUM CONTINUOUS RATING – 8% of the engine operating hours at 100% of rated power, 92% of the engine operating hours at 90% of rated power.

CONTINUOUS SERVICE RATING – 100% of the engine operating hours at 100% of rated power.

RATINGS are based on SAE J1995/ISO3046 standard conditions of 100 kPa (29.61 in. Hg), 25°C (77°F), and 30% relative humidity at the stated charge air cooler water temperature. Ratings also meet classification society maximum temperature requirements of 45°C (113°F) air temperature to the turbocharger and 32°C (90°F) seawater temperature without derate.

Additional ratings may be available for specific customer requirements. Consult your Caterpillar representative for additional information.

FUEL RATES are based on 35° API, 16°C (60°F) fuel used at 29°C (85°F) with a density of 838.9 g/liter (7.001 lbs/U.S. gal). Lower Heat Value (LHV) of 42 780 kJ/kg (18,390 Btu/lb). Tolerance is +5%. Includes all engine mounted pumps. BSFC without pumps is 3% less.

MARINE CERTIFICATION – Ratings are marine classification society approved by ABS, BV, CCS, DnV, GL, KR, LRS, NKK, RINA, and RS. These societies have also granted 3600 factory line production approval which eliminates requirement for society surveyor witness test.

Performance data is calculated in accordance with tolerances and conditions stated in this specification sheet and is only intended for purposes of comparison with other manufacturers' engines. Actual engine performance may vary according to the particular application of the engine and operating conditions beyond Caterpillar's control.

Materials and specifications are subject to change without notice.

The International System of Units (SI) is used in this publication.

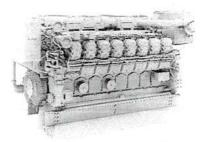
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Shown with Accessory Equipment

#### STANDARD EQUIPMENT

#### Air Inlet System

Corrosion-resistant separate circuit aftercooler core (air side); regular duty air cleaner; dual turbochargers, 152 mm (6 in.) OD

#### **Cooling System**

Non-self-priming centrifugal auxiliary sea water pump, gear driven centrifugal jacket water pump, auxiliary fresh water pump, expansion tank, oil cooler, thermostats and housing with 92°C (198°F) full open temperature

#### **Exhaust System**

Dry, gas tight manifolds with thermo-laminated heat shields; dual turbochargers with water cooled bearings and thermo-laminated heat shields; vertical exhaust outlet, 203 mm (8 in.) round flanged outlet

#### Flywheel and Flywheel Housing

SAE No. 00 (183 teeth)

#### Fuel System

RH fuel filter with service indicators, fuel transfer pump, electronically controlled unit injectors

#### Instruments

RH instrument panel with oil pressure, water temperature, and fuel pressure gauges; system DC voltage gauge; air inlet restriction gauge; exhaust temperature gauge; fuel and oil filter differential pressure gauges; service meter; tachometer; instantaneous fuel consumption; four-position start-stop

#### **Lube System**

Top-mounted crankcase breather, RH oil filter and oil level gauge, gear-type oil pump, deep sump oil pan

#### Mounting System

Engine length mounting rails, 254 mm (10 in.), C-channel

#### Power Take-Offs

Lower RH and LH accessory drive, two-sided front housing

#### General

Vibration damper and guard, Caterpillar yellow paint, lifting eyes

### Marine Auxiliary Engine

### 3516B

1383 bkW (1853 bhp) 1879 mhp @ 1200 rpm

#### **SPECIFICATIONS**

V-16, 4-Stroke-Cycle-Diesel
EmissionsIMO compliant
Displacement
Bore
Stroke 190 mm (7.5 in.)
AspirationTurbocharged-Aftercooled
Governor Electronic
Engine Weight, Net Dry (approx) 8029 kg (17700 lb)
Capacity for Liquids
Cooling System (engine only) 365.5 L (96.6 U.S. gal)
Lube Oil System 798.7 L (211 U.S. gal)
Oil Change Interval
Rotation (from flywheel end) ccw or cw

#### ACCESSORY EQUIPMENT

24V 60 Amp Alternator
24V Electric Prelube Pump
24V Electric Starting Motor
Air Inlet Overspeed Shutoffs
Air Starting Motor
Auxiliary Drive Pulley and Shaft
Crankshaft Pulleys
Customer Communication Module (CCM)
Dual Jacket Water Heater
Duplex Oil Filter
Duplex Oil Filter
Engine-Mounted Instrument Panel
Exhaust Elbow, Flange, Flexible Fitting
Front Enclosed Clutch, Front Stub Shafts
Fuel Priming Pump
Generator — 1285 to 1825 ekW
Air Filter, Bearing Temperature Detectors, Low
Voltage Extension Box, RFI Filter, Voltage Regulator
(Auto, Digital, Manual)
Heat Exchanger
Instrument Panel Extension Harness — 8M or 16M
Keel Cooling Connections
Load Sharing Module
Premium Wiring Harness
Program Relay Control Module
Pyrometer and Thermocouples
Pyrometer Extension Harness — 8M or 16M
Radiator Cooling Conversion
Self-Priming Auxiliary Sea Water Pump
Shutoff and Alarm Contactors for Oil Pres. and Water Temp.

#### Spare Parts Kit Spare Parts Kit Sump Pump Upper RH Front Accessory Drives Vibration Isolators PERFORMANCE DATA

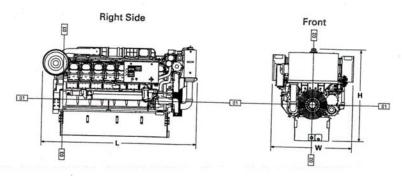
Turbocharged-Aftercooled

DM4609-00 Aftercooler Temperature 30°C (86°F)

1383 bkW (.8 pf) 1853 bhp				
% load	bkW	Lph	gph	
100	1344	334.2	88.3	
75	1007	246.7	65.2	
50	675	166.4	44.0	
25	346	93.5	24.7	

# CATERPILLAR'

# 3516B MARINE AUXILIARY ENGINE — 1383 bkW (1853 bhp)



#### **DIMENSIONS\***

Overail Length	mm	in.	The second secon	
Longth from f	3428.6	135.0		
Length from front to rear face of block	2555.0	100.6		
Length from rear face of block to back of flywheel housing	468.6	7.1		
Overall Height	2052.6	80.1		
Height from crankshaft centerline to top of engine	1317.9	51.9		
Height from crankshaft centerline to bottom of oil pan	734.7	28.9		
Overall Width	1785.0	70.3		
Width from crankshaft centerline to port side (left side)	892.5	35.1		
Width from crankshaft centerline to starboard side (right side)	892.5	35.1		

Front		nt	Rear	
Customer mounting balanting	mm	in.	mm	in.
Customer mounting hole diameter Width from crankshaft centerline to side	27.5	1.1	27.5	1.1
l anoth from cranksnam centerline to side	444.5	17.5	444.5	17.5
Length from rear face of block to mounting hole	2320.0	91.3	65.7	2.6
	2396.2	94.3	141.9	5.6
			10.5	0.4

<sup>\*</sup>Illustrations and dimensions from drawing: 145-8695.

## **RATING CONDITIONS**

Engine Performance Parameters	
Power	±3%
Specific Fuel Consumption	±3%
Fuel Rate	±5%

Ratings are based on SAE J1228/ISO8665 standard conditions of 100 kPa (29.61 in. Hg), 25°C (77°F), and 30% relative humidity. These ratings also apply at ISO3046/1, DIN6271/3, and BS5514 conditions of 100 kPa (29.61 in. Hg), 27°C (81°F), and 60% relative humidity.

Fuel rates are based on fuel oil of 35° API [16°C (60°F)] gravity having an LHV of 42 780 kJ/kg (18,390 Btu/lb) when used at 29°C (85°F) and weighing 838.9 g/L (7.001 lb/U.S. gal).

Additional ratings may be available for specific customer requirements. Consult your Caterpillar representative for additional information.

Performance data is calculated in accordance with tolerances and conditions stated in this specification sheet and is only intended for purposes of operating conditions beyond Caterpillar's control.

TMI Reference No.: DM4609-00 (6-15-01)
Materials and specifications are subject to change without notice.

The International System of Units (SI) is used in this publication.

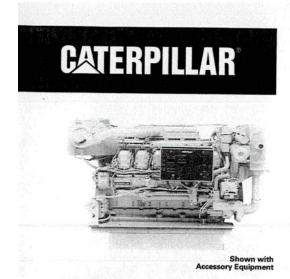
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## South Florida Water Management District EAA Reservoir A-1 Basis of Design Report

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## STANDARD EQUIPMENT

#### Air Inlet System

Corrosion-resistant, separate circuit aftercooler core (air side); regular duty air cleaner; dual turbochargers, 152 mm (6 in.) OD

#### Cooling System

Non-self-priming centrifugal auxiliary sea water pump, gear driven centrifugal jacket water pump, auxiliary fresh water pump, expansion tank, oil cooler, thermostats and housing with 92°C (198°F)

## **Exhaust System**

Dry, gas tight manifolds with thermo-laminated heat shields; dual turbochargers with watercooled bearings and thermo-laminated heat shields; vertical exhaust outlet, 305 mm (12 in.) round flanged outlet

#### Flywheel and Flywheel Housing

SAE No. 00 (183 teeth)

#### Fuel System

RH fuel filter with service indicators, fuel transfer pump, Electronic Unit Injector (EUI) fuel system

#### Instruments

RH instrument panel with oil pressure, water temperature, and fuel pressure gauges; system DC voltage gauge; air inlet restriction gauge; exhaust temperature gauges; fuel and oil filter differential pressure gauges; service meter; tachometer; instantaneous fuel consumption; 4-position start-stop

### **Lube System**

Top-mounted crankcase breather, RH oil filter and oil level gauge, gear-type oil pump, deep sump oil pan

#### **Mounting System**

Engine length mounting rails, 254 mm (10 in.), C-channel

## Power Take-Offs

Lower RH and LH accessory drive, two-sided front housing

#### General

Vibration damper and guard, Caterpillar yellow paint,

# Marine **Auxiliary** Engine

# 3512B

1257 bkW (1686 bhp) 1710 mhp @ 1500 rpm

#### **SPECIFICATIONS**

V-12, 4-Stroke-Cycle-Diesel
Displacement 51.8 L (3158 cu. in.)
Bore 170 mm (6.7 in.)
Stroke 190 mm (7.5 in.)
AspirationTurbocharged-Aftercooled
Governor Electronic
Engine Weight, Net Dry (approx) 6532 kg (14400 lb)
Capacity for Liquids
Cooling System (engine only). 289.3 L (76.4 U.S. gal) Lube Oil System
Oil Change Interval
Rotation (from flywheel end) ccw or cw

#### ACCESSORY EQUIPMENT

24V 60 Amp Alternator

24V Electric Prelube Pump 24V Electric Starting Motor Air Inlet Overspeed Shutoffs Air Inlet Overspeed Shutoffs
Air Starting Motor
Auxiliary Drive Pulley and Shaft
Crankshaft Pulleys
Customer Communications Module — CCM
Dual Jacket Water Heater
Duplex Fuel Filter
Duplex Oil Filter
Exhaust Elbow, Flange, Flexible Fitting
Front Enclosed Clutch
Front Stub Shafts
Fuel Priming Pump
Generator — 880 to 1360 ekW, Air Filter, Bearing
Temperature Detectors, Low Voltage Extension Box,
RFI Filter, Voltage Regulator (Auto, Digital, Manual)
Heat Exchanger RFI Filter, Voltage Regulator (Auto, Digital, Manu Heat Exchanger Instrument Panel Extension Harness — 8M or 16M Keel Cooling Connections Load Sharing Module Premium Instrument Panel Premium Wiring Harness Program Relay Control Module Pyrometer and Thermocouples Pyrometer Extension Harness — 8M or 16M Radiator Cooling Conversion Self Priming Auxiliary Sea Water Pump Self Priming Auxiliary Sea Water Pump Shutoff and Alarm Contactors for Oil Pres. and Water Temp. Spare Parts Kit Standard Sump Oil Pan Sump Pump Upper RH Accessory Drives

#### Vibration Isolators PERFORMANCE DATA

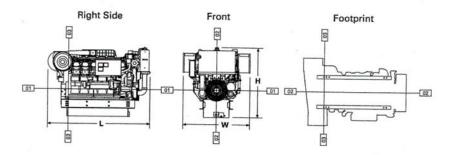
#### Turbocharged-Aftercooled

Aftercooler Temperature 30°C (86°F)

	1257 bkW (.	8 pf) 1686 bhp	
% load	bkW	Lph	gph
100	1257	291.9	77.1
75	939	225.3	59.5
50	625	158.4	41.8
25	316	89.8	23.7

# **CATERPILLAR**

# 3512B MARINE AUXILIARY ENGINE — 1257 bkW (1686 bhp)



#### **DIMENSIONS\***

	mm	in.	
Overall Length	3038.6	119.6	
Length from front to rear face of block	2420.0	95.3	
Length from rear face of block to back of engine	618.6	24.4	
Overall Height	2073.8	81.7	
Height from crankshaft centerline to top of engine	1267.1	49.9	
Height from crankshaft centerline to bottom of rails	806.7	31.8	
Overall Width	1988.0	78.3	
Width from crankshaft centerline to port side (left side)	994.0	39.1	
Width from crankshaft centerline to starboard side (right side)	994.0	39.1	

	Front		Hear	
	mm	in.	mm	in.
Customer mounting hole diameter	23.8	0.9	23.8	0.9
Width from crankshaft centerline to side	444.5	17.5	444.5	17.5
Length from rear face of block to mounting hole	1758.0	69.2	65.7	2.6
	1834.2	72.2	141.9	5.6
			10.5	0.4

<sup>\*</sup>Illustrations and dimensions from drawing: 125-6279.

### **RATING CONDITIONS**

Engine Performance Parameters	
Power	±3%
Specific Fuel Consumption	±3%
Fuel Rate	±5%

Ratings are based on SAE J1228/ISO8665 standard conditions of 100 kPa (29.61 in. Hg), 25°C (77°F), and 30% relative humidity. These ratings also apply at ISO3046/1, DIN6271/3, and BS5514 conditions of 100 kPa (29.61 in. Hg), 27°C (81°F), and 60% relative humidity.

Fuel rates are based on fuel oil of 35° API [16°C (60°F)] gravity having an LHV of 42 780 kJ/kg (18,390 Btu/lb) when used at 29°C (85°F) and weighing 838.9 g/L (7.001 lb/U.S. gal).

Additional ratings may be available for specific customer requirements. Consult your Caterpillar representative for additional information.

Performance data is calculated in accordance with tolerances and conditions stated in this specification sheet and is only intended for purpose comparison with other manufacturers' engines. Actual engine performance may vary according to the particular application of the engine and operating conditions beyond Caterpillar's control.

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Materials and specifications are subject to change without notice.

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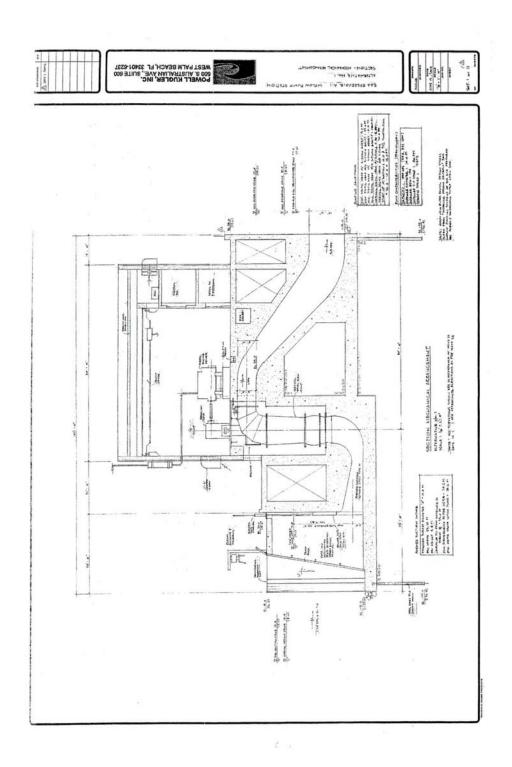
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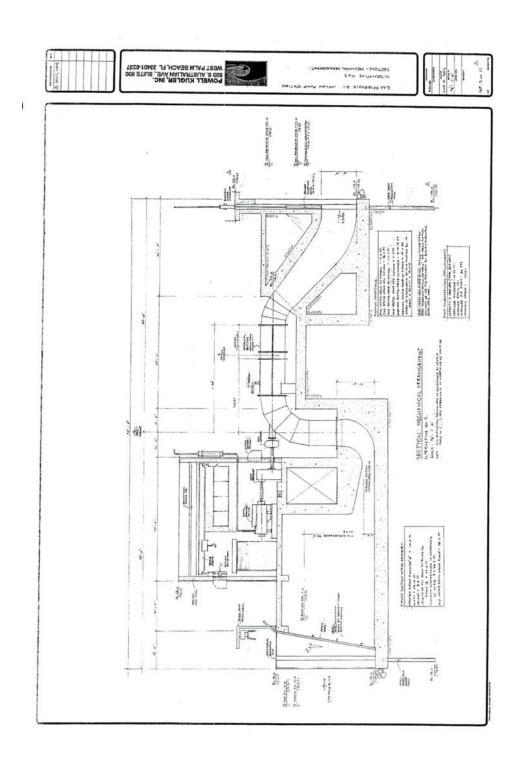
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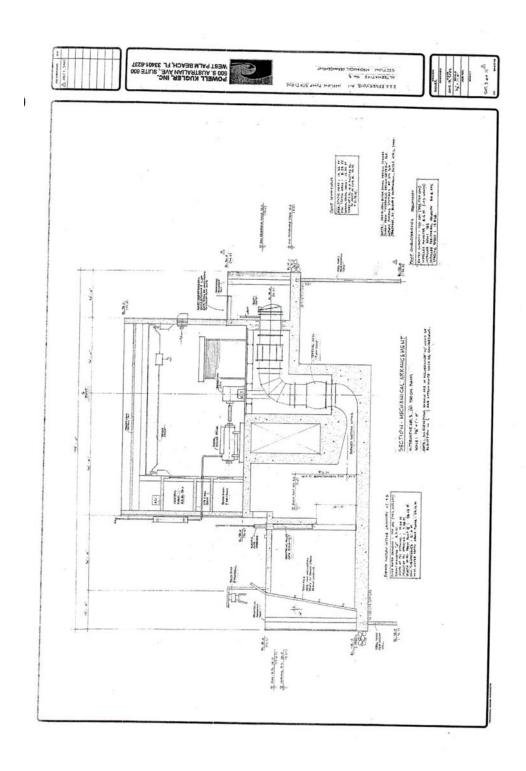
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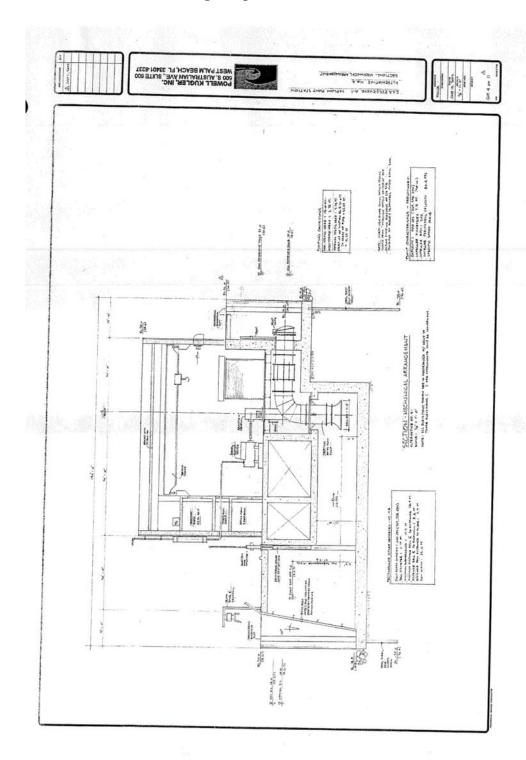
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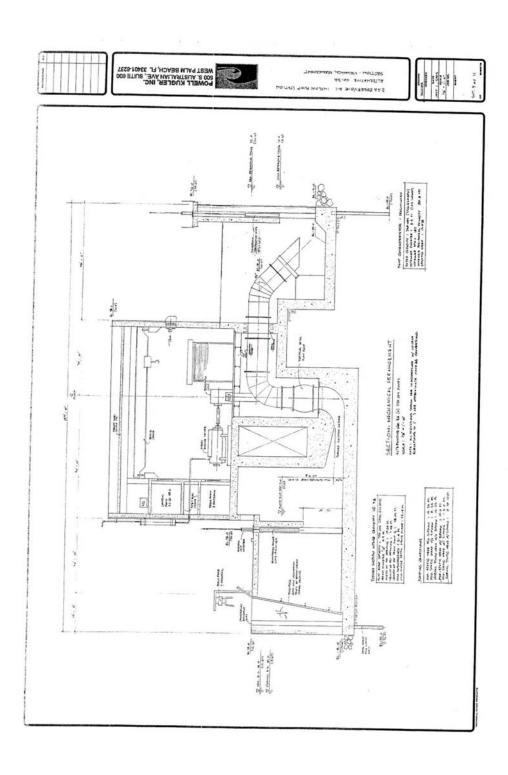
## **REFERENCE DRAWINGS**

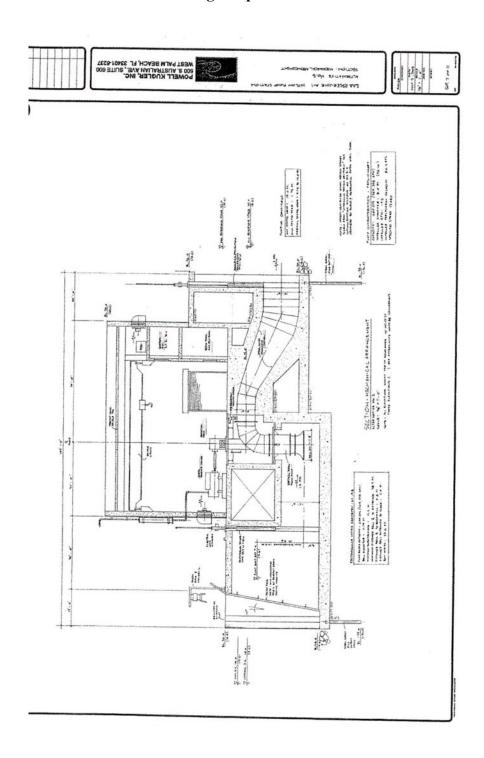


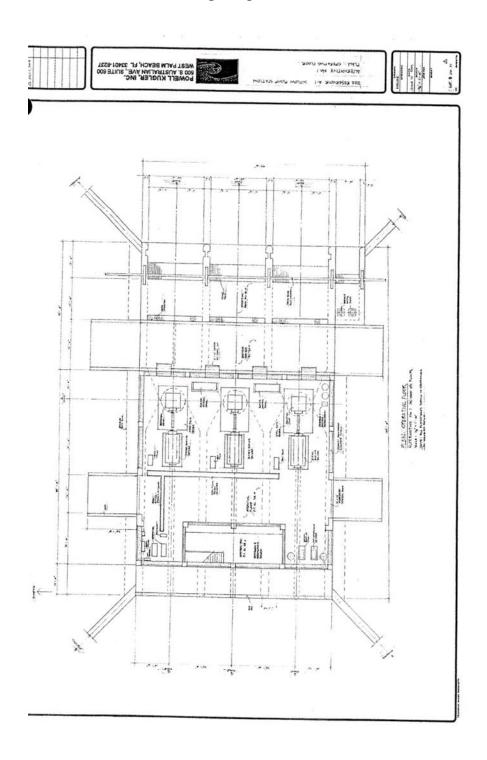






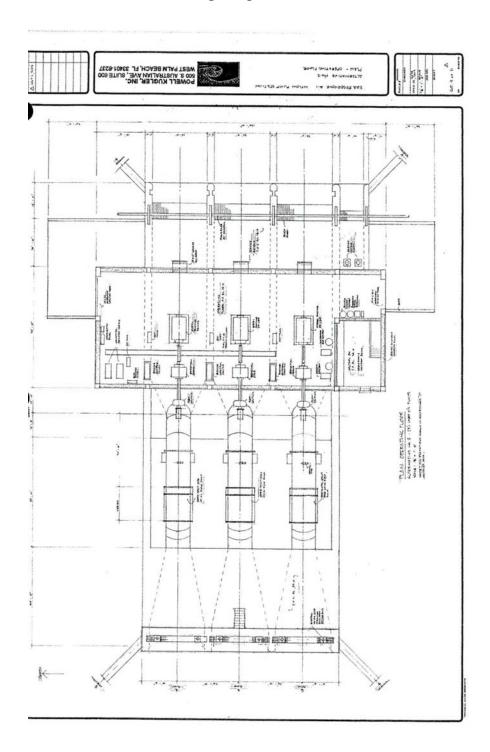


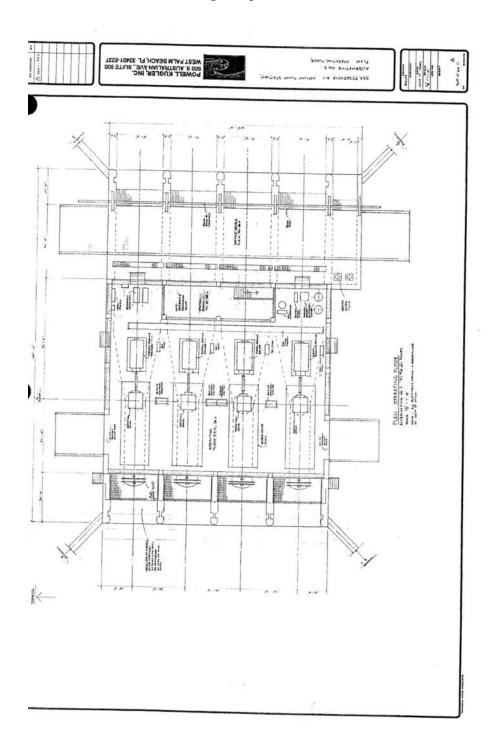




# South Florida Water Management District EAA Reservoir A-1 Basis of Design Report

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